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**ARGONNE NATIONAL LABORATORY  
PATENT PORTFOLIO**

**Compiled by**

**B. C. Huguelet**



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**ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS**

**Prepared for the U. S. ENERGY RESEARCH  
AND DEVELOPMENT ADMINISTRATION  
under Contract W-31-109-Eng-38**

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ARGONNE NATIONAL LABORATORY  
9700 South Cass Avenue  
Argonne, Illinois 60439

ARGONNE NATIONAL LABORATORY  
PATENT PORTFOLIO

Compiled by

B. C. Huguelet

Technology Transfer Office

January 1976

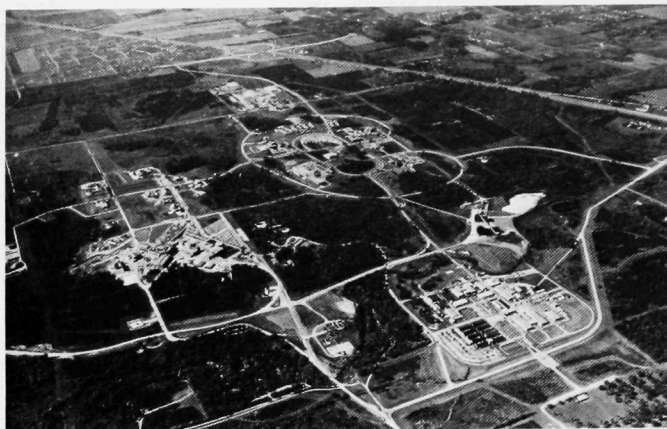




## TABLE OF CONTENTS

	PAGE
ARGONNE NATIONAL LABORATORY (ANL) -----	iv
FOREWORD -----	vi
INTRODUCTION -----	vii
PATENT LICENSING POLICY -----	viii
PATENT ABSTRACTS	
ATMOSPHERIC AND EARTH SCIENCES -----	1
BIOLOGICAL AND MEDICAL SCIENCES -----	2
CHEMISTRY AND CHEMICAL ENGINEERING -----	4
CRYOGENICS AND SUPERCONDUCTIVITY -----	7
ELECTRONICS AND ELECTRICAL ENGINEERING -----	8
ENERGY CONVERSION -----	13
MEASUREMENTS AND CONTROLS -----	16
METHODS AND DEVICES -----	19
MATERIALS AND FABRICATION -----	23
PHYSICS, ACCELERATORS AND FUSION -----	27
SELECTED NUCLEAR RELATED TECHNOLOGY -----	30
PATENT TITLES ONLY FOR ALL NUCLEAR FISSION RELATED TECHNOLOGY -----	35

## ARGONNE NATIONAL LABORATORY (ANL)



Argonne is one of the Nation's largest federally funded research and development centers. It is located on a 1700 acre site 27 miles southwest of Chicago, Illinois. The Laboratory carries out broad programs of fundamental research in the physical, biomedical and environmental sciences and serves as a major center for energy research and development. In addition to its growing responsibilities in developing new energy technologies, Argonne retains a major role in the Nation's Liquid Metal Fast Breeder Reactor (LMFBR) program.

Argonne is operated by The University of Chicago under a tripartite contract with the Energy Research and Development Administration (ERDA), the University and the Argonne Universities Association (AUA). The University operates the Laboratory in accordance with policies established jointly with AUA.

Of the total of some 4625 Argonne employees, more than 1650 are scientific and engineering staff. In addition to the Illinois site, a second site, called Argonne-West, is maintained at the Idaho National Engineering Laboratory, 40 miles west of Idaho Falls, Idaho. Much of the Laboratory's reactor development program is carried out at Argonne-West by some 700 employees. Argonne's total assets are in excess of \$450 million, and its FY 1976 budget is about \$150 million of which about 7.5% represents non-ERDA funding.

Since its creation as a national laboratory, Argonne has carried out a broad program of both fundamental research and applied development work. The scope and breadth of programs at ANL is evidenced in the following examples:

- Design, construction and operation of the Experimental Breeder Reactor II, the only operating U. S. breeder and the Nation's prime facility for irradiating fuels and materials in the fast breeder program.
- Work in the field of high energy physics including the design, construction and operation of a major particle accelerator.
- Pioneering major application of the principle of superconductivity to high-energy physics research, especially in the design and construction of superconducting coils for magnets of two of the world's largest hydrogen bubble chambers.
- Design, construction and operation of a 12-foot hydrogen-deuterium bubble chamber with a superconducting magnet—the first of a new generation of such large high-field facilities.
- Preparation of the first binary compounds between noble gases and fluorine or oxygen and analyses of the properties and molecular structure of these compounds.
- Important advances in cancer research and other biomedical programs, follow-up studies of persons once exposed to radium, and animal studies of the effects of plutonium ingestion.
- Investigations of the pathways of toxic trace elements and/or radionuclides in the Great Lakes as well as studies of the effects of heated discharges from power plants located on Lake Michigan.
- Development of batteries of high specific energy and high specific power for electric-vehicle propulsion and central station electrical energy storage.
- Investigation of the fluidized bed combustion of coal as a means of reducing the emission of pollutant gases; R&D in process chemistry and engineering in support of projects on coal conversion into clean fuels.
- Development and testing of several models of non-focussing solar concentrators for possible use in thermal and photovoltaic applications.
- Development of ERDA-wide computer code (LIFE) for fuel element performance description.
- Establishment of major capability, for the Nuclear Regulatory Commission (NRC), in development of Environmental Impact Statements.

Argonne's history is as long as the history of organized atomic energy in the United States. Its forerunner was the Metallurgical Laboratory, established at The University of Chicago in January 1942. (The Metallurgical Laboratory was a code name for an important segment of the World War II atomic bomb project.) There, on December 2, 1942, Enrico Fermi and his colleagues achieved the world's first controlled nuclear chain reaction.

As the end of World War II drew near, the Manhattan Engineering District atomic bomb project, of which the Metallurgical Laboratory was a part, was reorganized as the Atomic Energy Commission. On July 1, 1946, the Metallurgical Laboratory was officially renamed Argonne National Laboratory, and in 1948, it became the center of the AEC's reactor development program.

ANL has developed the capabilities to undertake the design and fabrication of total systems. ANL engineers carry design efforts completely through conception, analysis and computer modeling, design, fabrication, testing, and evaluation of test results. The Laboratory also has strong capabilities in scientific computation and information processing. It operates one of the Nation's largest modern computer installations.

ANL plays a major role in ERDA's Liquid Metal Fast Breeder Reactor program. It operates the Experimental Breeder Reactor II. ANL is, in addition, the leading ERDA laboratory in the areas of fast reactor physics and safety.

A multiprogram research and development institution with traditions in the development of nuclear energy systems and in fundamental biological and physical research, Argonne is now also developing other energy technologies. The "mix" of fundamental science and applied work has contributed substantially to the Laboratory's capabilities to solve technical problems and to move quickly and effectively into new programmatic areas. This combination of interdisciplinary research and development also serves to stimulate the Laboratory's basic research maximizing its productiveness and value to the Nation.

## FOREWORD

The primary objective of the Technology Transfer Office (TTO) at Argonne National Laboratory (ANL) is to enhance the flow of technological information to industry and to state and local governments. This booklet has been prepared in support of that objective.

The TTO also stands ready to assist by

1. Seeking to match the inquirer's needs with ANL's resources through person-to-person contact.
2. Answering questions drawing on ANL's scientific, engineering and technical staff who are knowledgeable in the physical sciences, engineering disciplines and life sciences.
3. Arranging visits with staff members to discuss problems.
4. Satisfying inquiries with technical publications or reprints, or advising of their existence and how to obtain them.
5. Suggesting referrals in situations where needs can be satisfied by private enterprise.
6. Arranging for the use, on a cost-recovery basis, of facilities and equipment whenever possible and when a technical problem requires the unique capabilities at ANL.
7. Sponsoring seminars on timely topics.

For additional information on the technology contained in this booklet or other ANL or ERDA technology please contact

Technology Transfer Office  
Argonne National Laboratory  
9700 S. Cass Avenue  
Argonne, Illinois 60439  
(312) 739-7711 Ext. 2718

## INTRODUCTION

This booklet contains the abstracts of all active U. S. patents on technology items that originated at ANL, the applicability of which is not limited to nuclear reactors. Also listed are the titles of all ANL-originated nuclear-related U. S. patents that are still in force. The booklet listings have been arranged into categories, as shown in the Table of Contents. Although some abstracts appear in more than one category, the cross indexing is not comprehensive and the reader is encouraged to examine all categories for items of interest. Selected technology items for which patent applications have been filed and are available for licensing have been included in several categories.

The full text of these patents may be obtained from

Commissioner of Patents  
U. S. Patent Office  
U. S. Department of Commerce  
Washington, D. C. 20231

upon request by number and payment of 50¢ per copy for each patent desired. Copies of patent applications that are available for licensing are available in both hardcopy and microfiche (priced individually) from

National Technical Information Service  
U. S. Department of Commerce  
5285 Port Royal Road  
Springfield, Virginia 22151



## PATENT LICENSING POLICY

All patents originating at ANL are assigned to the United States Government as represented by the Energy Research and Development Administration (ERDA). ERDA has been charged to encourage and support private sector utilization of the results, including patented technology, of its R&D programs. To that end, ERDA patent-licensing policy includes provision for exclusive as well as nonexclusive licensing of both patents and patent applications.

Questions related to licensing of any items listed should be directed to

Assistant General Counsel for Patents  
U. S. Energy Research and Development Administration  
Washington, D. C. 20545

# ----- ATMOSPHERIC AND EARTH SCIENCES -----

## ELECTRONIC BIVANE WIND DIRECTION INDICATOR

Patent No. : 2,983,144

Issued : 05/09/61

Inventor(s) : H. Moses

This patent relates to an apparatus for determining and recording three dimensional wind vectors. The apparatus comprises a rotatably mounted azimuthal wind component sensing head and an elevational wind component sensing head mounted to the azimuthal head and adapted to rotate therewith in the azimuthal plane and independently in the elevational plane. A heat source and thermocouples disposed thereabout are mounted within each of the sensing heads, the thermocouples providing electrical signals responsive to the temperature differential created by the passage of air through the sensing tubes. The thermocouple signals are applied to drive mechanisms which position the sensing heads to a null wind position. Recording means are provided responsive to positional data from the drive mechanisms which are a measurement of the three dimensional wind vectors.

## ATMOSPHERIC EDDY DISTURBANCE DETECTOR

Patent No. : 3,146,622

Issued : 09/01/64

Inventor(s) : H. Moses

This patent relates to devices for measuring and recording two dimensional patterns of atmospheric temperature or wind velocity. To measure temperature, a plastic tape, opaque to infrared radiation, is scanned by a rotating plane mirror mounted on a constant speed motor. A lens focuses the reflected radiation on an infrared detector cell the output of which is amplified so that it may be displayed on an oscilloscope containing a horizontal raster representing the successive scans of the tape. For measuring velocity the tape is replaced with wires which are suspended in the atmosphere and connected in parallel with a constant voltage source. The cooling of the wires is proportional to wind velocity and is detected and displayed by the same infrared detector and oscilloscope. Also described are means for calibrating the device and for shielding the sensors from solar and ground radiation.

## METHOD OF MEASURING WIND VELOCITY

Patent No. : 3,182,499

Issued : 05/11/65

Inventor(s) : H. Moses

This patent relates to a method of measuring wind velocity. Infrared radiation is generated and transmitted into the atmosphere to heat a portion thereof. The heated portion of the atmosphere is monitored at measured time intervals to determine its spatial coordinates. The velocity of the heated portion of the atmosphere is computed from the determined spatial coordinates and time intervals to give a value of wind velocity.

## METHOD OF DISCHARGING A CLOUD

Patent No. : 3,284,686

Issued : 11/08/66

Inventor(s) : H. Moses and R. L. Martin

This patent is for a method of discharging a cloud wherein a path of ionized air is established between the earth and a charge center of the cloud by transmitting a pulse of relativistic charged particles from a particle accelerator to the cloud charge center leaving in its wake the path of ionized air.

## SYSTEM FOR TRACKING AIR CURRENTS

Patent No. : 3,448,613

Issued : 06/10/69

Inventor(s) : J. Kastner and S. Halverson

This patent relates to a device for measuring atmospheric turbulence having a radiation emitting means which emits a beam of ionizing radiation into the atmosphere to ionize a column of air. A wave means detects signals reflected from the ionized column and determines the presence of air turbulence by displacements and distortions of the ionized air column.

## SEA WATER DESALINATION

Patent No. : 3,491,822

Issued : 01/27/70

Inventor(s) : D. Ramaswami and A. A. Jonke

This patent relates to a method by which atomized sea water is sprayed into a fluidized bed of salt particles. Evaporation of fresh water from the surface of the salt particles leaves solid salt in the bed but no brine. Multiple beds may be used.

## ANEMOMETER FOR MEASURING HORIZONTAL WIND VELOCITIES

Patent No. : 3,541,855

Issued : 11/24/70

Inventor(s) : P. Frenzen and R. L. Hart

This patent relates to an anemometer including a rotatable shaft and means for measuring the velocity of rotation of the shaft. A first set of three anemometer cups are equispaced about the shaft in a plane normal thereto to rotate therewith. A second set of three anemometer cups are equispaced about the shaft between the first set of anemometer cups in a plane normal to the shaft to rotate therewith. The planes of the two sets of anemometer cups are separated along the shaft a distance which is proportional to the diameter of the cups and the radial distance of the cups from the shaft.

## METHOD FOR MEASURING THE HEIGHT OF ATMOSPHERIC AEROSOL AIR

Patent No. : 3,702,565

Issued : 11/14/72

Inventor(s) : H. Moses, D. N. Eggenberger,  
S. L. Halverson and W. W. Managan

This patent relates to a method of measuring the depth of the aerosol-contaminated layers of air (aerosol layer) which is presented. Measurements are made of solar radiation at vertically or horizontally displaced positions and the height of the aerosol layer calculated from the measurements. The measurements can be made by two displaced instruments at two zenith distances, by two pairs of vertically displaced instruments with one instrument of each pair receiving radiation of a first wave length and the other instrument of each pair receiving radiation of a second wave length or by two vertically displaced instruments with a third instrument positioned centrally therebetween. The height of aerosol layers separated by clear layers is also determined.

## ATMOSPHERE PURIFICATION OF RADON AND RADON DAUGHTER ELEMENTS

Patent No. : 3,788,499 (See Chemistry and Chemical Engineering)

## ATMOSPHERE PURIFICATION OF RADON AND RADON DAUGHTER ELEMENTS

Patent No. : 3,784,674 (See Chemistry and Chemical Engineering)

## ATMOSPHERE PURIFICATION OF XENON, RADON AND RADON DAUGHTER ELEMENTS

Patent No. : 3,829,551 (See Chemistry and Chemical Engineering)

## TEMPERATURE MEASUREMENT DEVICE

Patent No. : 3,869,918 (See Measurements and Controls)

## CONDENSATION NUCLEUS DISCRIMINATOR

Patent No. : 3,890,046 Issued : 06/17/75 Inventor(s) : E. J. Hart, K. N. Vasudevan and K. H. Schmidt

This patent describes a device for determining the critical radius and the absolute concentration of condensation nuclei within gas samples during a single interval of pressure reduction. The device includes means for monitoring the pressure along with the transient changes in the scattering and attenuation of a monochromatic light beam passing through a cloud of fog droplets during their growth from the nuclei in the sample. From these measurements useful data respecting aerosol formation can be obtained for environmental studies and basic research.

## ----- BIOLOGICAL AND MEDICAL SCIENCES -----

## METHOD OF USING AND MANUFACTURING PLASTIC EQUIVALENT TO ORGANIC MATERIALS

Patent No. : 3,005,794 Issued : 10/24/61 Inventor(s) : F. R. Shonka, J. E. Rose, G. Failla

This patent relates to compositions of matter that have the radiation response of animal muscle tissue, bone or air. These compositions of matter are composed of specific proportions of three or more of the following constituents: polyethylene plastic, polyamide plastic, oil furnace black, silica and calcium fluoride.

## METAL PHTHALOCYANINES

Patent No. : 3,027,391 Issued : 03/27/62 Inventor(s) : N. A. Frigerio

This patent deals with a process of preparing heavy metal phthalocyanines sulfonated or not, by mixing an inorganic metal salt with dimethyl formamide or methyl sulfoxide; separating the metal complex formed from the solution; mixing the complex with an equimolar amount of sodium, potassium, lithium, magnesium or beryllium sulfonated or unsulfonated phthalocyanine whereby heavy-metal phthalocyanine crystals are formed; and separating the crystals from the solution. Uranyl, thorium, lead, hafnium, and lanthanide rare earth phthalocyanines can be produced by the process. Modifications of this method and the compounds obtained are also claimed.

## PROCESS FOR CONTROLLING ANIMAL GROWTH RATE

Patent No. : 3,029,184 Issued : 04/10/62 Inventor(s) : W. J. Visek

This patent shows a method of injecting growing animals with the enzyme urease subcutaneously in increasing dosages. This generates within the blood anti-urease which enters the intestinal tract and inhibits the enzymatic decomposition of urea by urease in that location. Ammonia, one of the decomposition products, is thereby kept from diffusing through the intestinal walls into the blood, and this greatly reduces the energy requirements of the liver for removing the ammonia, thereby increasing the feeding efficiency of the animals.

## BIOLOGICAL IRRADIATION FACILITY

Patent No. : 3,031,394 Issued : 04/24/62 Inventor(s) : W. H. McCorkle and H. S. Cern

This patent relates to a facility for irradiating biological specimens with neutrons. It includes a nuclear reactor wherein the core of the reactor is off center in a reflector. A high-exposure room is located outside the reactor on the side nearest the core while a low-exposure room is located on the opposite side. Means for converting thermal neutrons to fast neutrons are movably disposed between the reactor core and the high and low-exposure rooms.

## EXPERIMENTAL ANIMAL MAINTENANCE

Patent No. : 3,074,375 Issued : 01/22/63 Inventor(s) : M. P. Finkel

This patent relates to a housing battery for experimental animals comprising a central supporting member having an upstanding rim, a flat bottom and outwardly sloping side having feeding openings, and a plurality of individual animal translucent plastic enclosures, each enclosure having an extended downturned roof portion adapted to engage said upstanding rim from above, long sides terminating at one end in sloping boundaries having slopes equal to those of said outwardly sloping sides of said supporting member, an opening between said sloping boundaries giving access to said feeding openings, and an extension adapted to come into contact with said bottom from below.

## EXPERIMENTAL ANIMAL WATERING DEVICE

Patent No. : 3,127,872

Issued : 04/07/64

Inventor(s) : M. P. Finke1

This patent shows a device for watering experimental animals confined in a battery of individual plastic enclosures. It consists of a rectangular plastic enclosure having a plurality of fluid-tight compartments, each with a drinking hole near the bottom and a filling hole on the top. The enclosure is immersed in water until filled, its drinking holes sealed with a strip of tape, and it is then placed in the battery. The tape sealing prevents the flow of water from the device, but permits animals to drink by licking the drinking holes.

## ANIMAL WATERING NIPPLE AND BOTTLE CAP COMBINATION

Patent No. : 3,149,611

Issued : 09/22/64

Inventor(s) : J. W. Harrison

This patent relates to an animal watering device for use in laboratories handling large numbers of small animals such as mice, hamsters, etc. A reusable stainless steel nipple is inserted into a central hole in a plastic bottle cap. A flange on the nipple is supported by the rim of the capped bottle. Automatic bottle washing, sterilizing and capping equipment is used to cut labor costs and eliminate problems associated with conventional rubber stoppers.

## SCANNING ELECTRON MICROSCOPE

Patent No. : 3,191,028

(See Electronics and Electrical Engineering)

## PARALLEL FLOW HEMODIALYZER

Patent No. : 3,522,885

Issued : 08/04/70

Inventor(s) : A. R. Lavender and F. W. Markley

This patent relates to a parallel flow hemodialyzer in which blood flows through a plurality of parallel tubes formed of a semipermeable membranous material and dialysate flows outside these tubes wherein a layer of epoxy resin surrounds the ends of the tubes and extends into the manifolds between the tubes forming a seal between the blood manifolds and the dialysate chamber.

## PARALLEL FLOW HEMODIALYZER

Patent No. : 3,565,258

Issued : 02/23/71

Inventor(s) : A. R. Lavender and F. W. Markley

A hemodialyzer includes a plurality of closely packed parallel semipermeable membranes through which dialysate flows while blood flows around them. Flaps at the ends of the membranes are sealed to each other by epoxy resin.

## READING AND WRITING MACHINE USING RAISED PATTERNS

Patent No. : 3,624,772

Issued : 11/30/71

Inventor(s) : A. P. Grunwald

This patent relates to a braille reading and writing machine for use by blind persons. The machine includes a reading belt upon which raised braille patterns are formed and magnetic tape which stores the information. The magnetic tape is divided into a plurality of information portions which the machine can selectively read. Provision is made for writing on selected portions of the tape or on blank tape. A simple tape drive mechanism is provided which prevents slack in the tape yet does not require a variable speed drive. The reading belt is formed of plastic with bubbles having two stable positions molded therein.

## COMPACT DIALYZER

Patent No. : 3,746,175

Issued : 07/17/73

Inventor(s) : F. W. Markley

This patent relates to a compact dialyzer which has capillary tubes orderly arranged in layers to provide a large surface area for dialysis in a small volume. Each layer of capillary tubes consists of a single row of parallel tubes whose axes are angularly disposed to the axes of the tubes in each of the two adjacent layers while the axes of the tubes of alternate layers are parallel. The dialyzer is manifolded such that a first-fluid passes through all the capillary tubes while a second-fluid passes over the capillary tubes between each adjacent pair of layers parallel to the planes of the layers.

## HEMODIALYZER WITH TAPERED SLIT BLOOD PORTS AND BAFFLES

Patent No. : 3,778,369

Issued : 12/11/73

Inventor(s) : F. W. Markley

This patent relates to a parallel flow hemodialyzer which has baffles to direct blood flow and a tapered blood port, the hemodialyzer providing greater dialysis efficiency and better blood flow distribution. Baffles are placed across the width of the tubes from one side wall of the casing forcing the blood to flow around the baffles across the tubes a multiple number of times in passing through the hemodialyzer. The baffles are made from epoxy resin strips placed across the width of each tube.

## FOLDED MEMBRANE DIALYZER

Patent No. : 3,788,482

Issued : 01/29/74

Inventor(s) : F. W. Markley

This patent describes apparatus for the dialysis of two fluids and the method of making the same and is directed particularly to apparatus for the dialysis of blood comprising a semipermeable membrane in sheet form folded into a large number of very closely spaced pleats. Support members are provided in all the pleats on one side of the membrane, all of the edges of which are sealingly embedded in a nonadhesive plastic material constituting at least a portion of the housing to give separate fluid chambers on the two sides of the membrane.

## SLOTTED COAXIAL GERMANIUM GAMMA-RAY CAMERA

Patent No. : 3,803,416

(See Selected Nuclear Related Technology)

## IMPLANTABLE BATTERY

Patent No. : 3,823,037

(See Energy Conversion)



## PHOTOCHEMICAL STIMULATION OF NERVES

Patent No. : 3,900,034

Issued : 08/19/75

Inventor(s) : J. J. Katz and T. R. Janson

This patent describes a method provided for stimulating a nerve or a severed nerve by placing a low power laser, preferably a photodiode laser, near the nerve and irradiating the nerve with the output from the laser. An end organ response is elicited upon irradiation of the attached nerve fiber. The output from the laser is of a nondestructive intensity such that the nerve and the tissue surrounding the nerve are not injured. The photochemical stimulation of the nerve is enhanced by staining the nerve to be stimulated with a sensitive vital stain prior to the laser irradiation of the nerve.

## LIPOSOME-ENCAPSULATED ACTINOMYCIN FOR CANCER CHEMOTHERAPY

Serial No. : 513,210

Filed : 10/19/74

Inventor(s) : Yueh-Erh Rahman and E. A. Cerny

An improved method is provided for chemotherapy of malignant tumors by injection of antitumor drugs. The antitumor drug is encapsulated within liposomes and the liposomes containing the encapsulated drug are injected into the body. The encapsulated drug penetrates into the tumor cells where the drug is slowly released and induces degeneration and death of the tumor cells, while any toxicity to the host body is reduced. Liposome encapsulation of actinomycin D has been found to be particularly effective in treating cancerous abdominal tumors, while drastically reducing the toxicity of actinomycin D to the host.

## ----- CHEMISTRY AND CHEMICAL ENGINEERING -----

## SEPARATION OF METAL SALTS BY ADSORPTION

Patent No. : 2,869,983

Issued : 01/20/59

Inventor(s) : D. M. Gruen

It has been found that certain metal salts, particularly the halides of iron, cobalt, nickel, and the actinide metals are readily absorbed on aluminum oxide, while certain other salts, particularly rare earth metal halides, are not so absorbed. Use is made of this discovery to separate uranium from the rare earths. The metal salts are first dissolved in a molten mixture of alkali metal nitrates, e.g., the eutectic mixture of lithium nitrate and potassium nitrate, and then the molten salt solution is contacted with alumina, either by slurring or by passing the salt solution through an absorption tower. The process is particularly valuable for the separation of actinides from lanthanum-group rare earths.

## SOLVENT EXTRACTION OF RUTHENIUM

Patent No. : 2,894,816

Issued : 07/14/59

Inventor(s) : H. H. Hyman and G. R. Leader

This patent deals with the separation of ruthenium from aqueous solutions by solvent extraction. According to the invention, a nitrite selected from the group consisting of alkali nitrite and alkaline earth nitrite in an equimolecular quantity with regard to the quantity of ruthenium present is added to an aqueous solution containing ruthenium tetranitrate to form a ruthenium complex. Adding an organic solvent such as ethyl ether to the resulting mixture selectively extracts the ruthenium complex.

## SEPARATION OF RUTHENIUM FROM AQUEOUS SOLUTIONS

Patent No. : 2,894,818

Issued : 07/14/59

Inventor(s) : M. Beederman, S. Vogler and H. H. Hyman

This patent deals with the improved separation of ruthenium from a ruthenium containing aqueous solution. The separation is accomplished by adding sodium nitrate, silver nitrate and ozone to the ruthenium containing aqueous solution to form ruthenium tetroxide and then volatilizing off the ruthenium tetroxide.

## METHOD OF PREPARING METAL FLUORIDES

Patent No. : 2,899,269

Issued : 08/11/59

Inventor(s) : J. J. Katz and I. Sheft

This patent relates to a method of preparing the halides of elements which are relatively non-reactive with halogenating agents. The method involves reacting a mixture of an oxygen containing salt of a difficultly halogenated metal with an oxygen containing salt of an easily halogenated metal with a halogenating agent. Accordingly plutonium tetrafluoride is produced by reacting a mixture of plutonium dioxide and uranium octa-oxide with bromine trifluoride. The reaction proceeds smoothly at moderate temperatures and the resulting plutonium trifluoride may be readily separated from many impurities which form volatile fluorides by volatilizing these volatile fluorides from the reaction chamber.

## MULTISTAGE FLUIDIZED BED REACTOR

Patent No. : 2,911,290

Issued : 11/03/59

Inventor(s) : A. A. Jonke, J. E. A. Graae and  
N. M. Levitz

This patent covers a multistage fluidized bed reactor in which each of a number of stages is arranged with respect to an associated baffle so that a fluidizing gas flows upward and a granular solid downward through the stages and baffles, whereas the granular solid stops flowing downward when the flow of fluidizing gas is shut off.



## SEPARATION OF RARE EARTHS BY SOLVENT EXTRACTION

Patent No. : 2,955,913

Issued : 10/11/60

Inventor(s) : D. F. Peppard and G. W. Mason

This patent deals with a process of separating lanthanide rare earths from each other from an aqueous mineral acid solution, e. g. hydrochloric or nitric acid of a concentration of above 3 M, preferably 12-16 M, by extraction with a water-immiscible alkyl phosphate, such as tributyl phosphate or a mixture of mono-, di- and tributyl phosphate, and fractional back-extraction with mineral acid whereby the lanthanides are taken up by the acid in the order of increasing atomic number.

## PURIFICATION OF ETHER

Patent No. : 3,003,002

Issued : 10/03/61

Inventor(s) : R. N. Feinstein

This patent deals with a process of removing peroxides from ethers by adsorption of the peroxides on a strong-base anion exchange resin in its hydroxyl form. Incorporation of the resin for storage is also covered.

## METHOD OF USING AND MANUFACTURING PLASTIC EQUIVALENT TO ORGANIC MATERIALS

Patent No. : 3,005,794

(See Biological and Medical Sciences)

## METAL PHTHALOCYANINES

Patent No. : 3,027,391

(See Biological and Medical Sciences)

## PROCESS FOR SEPARATING YTTRIUM FROM THE RARE EARTHS BY SOLVENT EXTRACTION

Patent No. : 3,110,556

Issued : 11/12/63

Inventor(s) : D. F. Peppard and G. W. Mason

This patent deals with a process of isolating yttrium from other rare earths present together with it in aqueous solutions. Yttrium and rare earths heavier than yttrium are first extracted with dialkyl phosphoric acid, after adjustment of the acidity to 2 N, and then back-extracted with 5-6 N mineral acid to form a strip solution. Thiocyanate is added to the strip solution and the rare earths heavier than yttrium are then selectively extracted with trialkyl phosphate, dialkyl phosphoric acid, alkyl phosphonate or dialkyl aryl phosphonate, leaving the yttrium in the aqueous solution.

## POLYMERIZATION OF ISOBUTYLENE

Patent No. : 3,174,921

Issued : 03/23/65

Inventor(s) : M. S. Matheson

This patent relates to a method of polymerizing isobutylene comprising irradiating a mixture of equal parts of isobutylene and isopentane in a vacuum with ultraviolet light having a wave length lower than 1600 Å at a temperature between -150°C and -160°C.

## XENON TETRAFLUORIDE AND PROCESS OF MAKING SAME

Patent No. : 3,183,061

Issued : 05/11/65

Inventor(s) : H. H. Claassen, H. Selig and J. G. Malm

This patent covers XeF<sub>4</sub>, and also process of preparing same by reacting xenon and fluorine at 350-450°C. and cooling.

## XENON HEXAFLUORIDE AND METHOD OF MAKING

Patent No. : 3,192,016

Issued : 06/29/65

Inventor(s) : J. G. Malm, I. Sheft, C. L. Chernick and H. H. Claassen

This patent relates to XeF<sub>6</sub> and to a process of preparing same comprising heating xenon gas and at least 10 moles of fluorine gas per mole of xenon in a closed system to between 200 and 400°C.

## FLUIDIZATION OF SINTERABLE FINES

Patent No. : 3,273,974

Issued : 09/20/66

Inventor(s) : J. D. Gabor and M. G. Baerns

This patent relates to a method for fluidizing and reacting sinterable fines by mixing the fines with larger inert particles to form a bed, fluidizing with an inert gas thereby creating a zone of agitation in the upper portion of the bed and introducing reaction gas into the agitated portion of the bed.

## METHOD OF OPERATING AN ION SOURCE FOR A TIME-OF FLIGHT MASS SPECTROMETER

Patent No. : 3,296,434

(See Physics, Accelerators and Fusion)

## METAL PERXENATES AND METHOD OF MAKING THE SAME

Patent No. : 3,305,343

Issued : 02/21/67

Inventor(s) : J. G. Malm and E. H. Appelman

This patent relates to a new chemical compound of xenon and the method of making the compound, and more particularly to the formation of metal perxenate.

## BORON-LOADED LIQUID SCINTILLATOR

Patent No. : 3,372,127

Issued : 03/05/68

Inventor(s) : G. E. Thomas, Jr. and H. E. Jackson, Jr.

This patent relates to a liquid scintillator which differentiates between radiation due to slow neutrons and gamma rays comprising a solvent of either toluene, xylene, mineral oil or isopropyl biphenyl containing 40 to 50 weight per cent trimethyl borate and saturated with 9, 10-diphenyl anthracene and naphthalene.

## OXYGEN SCAVENGING METHOD

Patent No. : 3,387,969

(See Materials and Fabrication)

## METHOD OF QUANTITATIVE ANALYSIS OF REDUCIBLE SUBSTANCES WITH HYDRATED ELECTRONS

Patent No. : 3,429,667

Issued : 02/25/69

Inventor(s) : E. J. Hart and E. M. Fielden

This patent relates to a method of analyzing an aqueous solution containing a very small quantity of a reducible substance to determine the concentration of the substance. The solution, which has a pH of 11 to 12 and has been saturated with hydrogen, is irradiated with a low-intensity pulse of radiation capable of producing hydrated electrons in the solution. A beam of light is passed through the solution and the change in transmission of the light as the hydrated electrons decay is compared with a standard.

## BROMINE PENTAFLUORIDE DISPOSAL

Patent No. : 3,469,936

Issued : 09/30/69

Inventor(s) : A. A. Chilenskas and J. E. Kincinas

This patent relates to bromine pentafluoride disposal. Bromine pentafluoride is passed through a bed of activated alumina to form solid aluminum fluoride and bromine gas. The bromine gas is then passed through a bed of soda lime which reacts with the bromine to complete the disposal of bromine pentafluoride.

## 2-ARYL INDOLES AND METHODS FOR THEIR USE

Patent No. : 3,478,208

Issued : 11/11/69

Inventor(s) : D. L. Horrocks and H. O. Wirth

This patent relates to a method for detecting and measuring ionizing radiation by directing the radiation into an organic scintillator solution in toluene of N-n-butyl-2-biphenylindole or solutions in toluene of other N substituted indoles.

## TELLURIUM HEXAFLUORIDE REMOVAL METHOD

Patent No. : 3,491,513

Issued : 01/27/70

Inventor(s) : D. R. Vissers, M. J. Steindler, and J. T. Holmes

This patent relates to a method by which tellurium hexafluoride and fluorine are removed from a gas by passing the gas through a fluidized bed of activated alumina to remove the greater portion of fluorine and thereafter passing the effluent from the fluidized bed through a packed bed of activated alumina to remove the tellurium hexafluoride.

## SEA WATER DESSALINATION

Patent No. : 3,491,822

(See Atmospheric and Earth Sciences)

## DEVICE FOR PRODUCING AND MONITORING HYDRATED ELECTRONS

Patent No. : 3,535,087

Issued : 10/20/70

Inventor(s) : E. J. Hart and K. H. Schmidt

This patent relates to a relatively simple photolytic device for producing and detecting hydrated electrons in sufficient quantities and with adequate sensitivity to be useful for demonstration, research and analytical purposes. Also described is a spherical mirror arrangement which increases the sensitivity of the detection system, permitting smaller quantities of hydrated electrons to be analyzed than would otherwise be possible.

## ANNULAR PACKED-BED FILTER

Patent No. : 3,541,762

Issued : 10/24/70

Inventor(s) : Devabaktuni Ramaswami, A. A. Jonke and N. M. Levitz

An off-gas produced by passing a fluorine-containing gas upwardly through a fluidized bed containing alumina is passed transversely through an annular filter containing alumina. The alumina in the annular filter is periodically dumped into the fluidized bed.

## SEPARATION OF SCANDIUM FROM RARE EARTH ELEMENTS

Patent No. : 3,554,693

Issued : 01/12/71

Inventor(s) : A. Orlandini and J. Korkisch

This patent relates to a process for purifying scandium and for separating scandium and for separating scandium values from the rare earths and other values by dissolving the values in an aqueous hydrochloric acid solution which is then mixed with a water-miscible organic solvent containing an organic phosphorus compound. The resulting mixture is passed over a cation exchange resin bed where the rare earths and other values are absorbed by the resin and the pure scandium values pass through the bed and are recovered from the effluent.

## SELECTIVE ION-EXCHANGE SEPARATION OF ALKALI METALS

Patent No. : 3,554,709

Issued : 01/12/71

Inventor(s) : A. Orlandini and J. Korkisch

This patent relates to a method of separating alkali metal values from other elements contained in an acid feed solution by evaporating the solution to near dryness and dissolving the resulting residue in a solvent solution consisting of 2-thenoyltrifluoroacetone in pyridine and pass the resulting organic feed solution over a cation-exchange resin bed whereby the alkali metal values are retained on the resin and the other elements pass through the bed with the effluent.

## BRIGHT LINE EMISSION SOURCE FOR ABSORPTION SPECTROSCOPY

Patent No. : 3,600,091

Issued : 08/17/71

Inventor(s) : J. A. Goleb, J. P. Bobis, and F. R. George

This patent relates to an improved light source for atomic absorption spectroscopy. The element to be analyzed is in the form of a gas contained in a gas discharge tube. The gas is subjected to high frequency electromagnetic radiation which excites the atoms of the gas causing them to emit a constant intensity light. The gas is also subjected to a relatively low frequency time varying magnetic field which causes the light emitted from the gas to be amplitude or intensity modulated. The amplitude modulation of the light increases the sensitivity of the detection process used.

METHOD FOR DISPERSING  $\text{Cr}^{3+}$  IONS IMPREGNATED IN SILICA

Patent No. : 3,748,283

Issued : 07/24/73

Inventor(s) : D. E. O'Reilly and J. E. Salamony

This patent relates to an invention which deals with a method for forming a catalyst of  $\text{Cr}^{3+}$  ions impregnated in a high specific surface area support material containing silica wherein the  $\text{Cr}^{3+}$  ions are predominantly in a dispersed state. The support material is first impregnated with a solution of oxalic acid and chromium nitrate. This impregnated material is then exposed to an oxidizing gas to oxidize the oxalic acid while simultaneously being heated to decompose the nitrate. The material is then exposed to a reducing gas to lower the oxidation state of the chromium ions impregnated therein resulting in a support material impregnated with highly dispersed  $\text{Cr}^{3+}$  ions.

## ATMOSPHERE PURIFICATION OF RADON AND RADON DAUGHTER ELEMENTS

Patent No. : 3,778,499

Issued : 12/11/73

Inventor(s) : L. Stein

This patent relates to a method for purifying an atmosphere of radon and radon daughter elements which may be contained therein by contacting the atmosphere with a fluorinating solution, whereby the radon and radon daughters are oxidized to their respective fluorides. The fluorides dissolve in the fluorinating solution and are removed from the atmosphere, which may then be recirculated.

## ATMOSPHERE PURIFICATION OF RADON AND RADON DAUGHTER ELEMENTS

Patent No. : 3,784,674

Issued : 01/08/74

Inventor(s) : L. Stein

This patent relates to a method of removing radon and radon daughter elements from an atmosphere containing these elements by passing the atmosphere through a bed of a fluorinating compound whereby the radon and radon daughters are oxidized to their respective fluorides. These fluorides adhere to the fluorinating compound and are thus removed from the atmosphere which may then be recirculated. A method for recovering radon and separating radon from its daughter elements is also described.

## ATMOSPHERE PURIFICATION OF XENON, RADON AND RADON DAUGHTER ELEMENTS

Patent No. : 3,829,551

Issued : 08/13/74

Inventor(s) : L. Stein

This patent describes a method of purifying an atmosphere of xenon, radon and radon daughter elements by passing the atmosphere containing these elements through a reaction bed of dioxygenyl hexafluoroantimonate, which oxidizes the xenon, radon and radon daughter elements to their respective fluorides which remain in the reaction bed.

## ----- CRYOGENICS AND SUPERCONDUCTIVITY -----

## PROCESS OF PRODUCING A NIOBIUM-TIN COMPOUND

Patent No. : 3,084,041

Issued : 04/02/63

Inventor(s) : S. T. Zegler and J. B. Darby, Jr.

This patent deals with a process of preparing pure  $\text{Nb}_3\text{Sn}$  by heating powders of niobium and excess tin to 900 to 1000°C., whereby niobium reacts with the molten tin forming  $\text{Nb}_3\text{Sn}$ ; cooling and powdering the product and immersing the powder in concentrated hydrochloric acid for removal of excessive tin; separating the  $\text{Nb}_3\text{Sn}$ , rinsing and drying it and sintering it in an inert atmosphere at 900 to 1300°C.

## SEAL

Patent No. : 3,238,574

Issued : 03/08/66

Inventor(s) : K. B. Martin, E. G. Pewitt, T. H. Fields and J. G. Fetkovich

This patent covers a seal that is leak-tight at high and low pressure differences and over wide ranges of temperature and is used between a metal mounting and an acrylic-resin lens associated with a bubble chamber. When the bubble chamber is cooled to a very low temperature, the contraction of the lens is appreciably greater than that of the mounting. Compensation for this unequal contraction is provided by two aluminum rings in the seal, one formed as a U having legs transverse to the axis of the ring, the other having a convolution in the shape of a U having legs parallel to the axis of the ring.

## SUPERCONDUCTING CABLE

Patent No. : 3,306,972

Issued : 02/28/67

Inventor(s) : C. Laverick, M. H. Foss and G. M. Lobell

This patent relates to superconducting cables. A plurality of superconductors are spatially mounted with respect to each other and a coating is disposed about the superconductors to form a superconducting cable. The coating has high thermal and electrical conductivity at liquid helium temperatures.

## METHOD FOR EVALUATING THE STABILITY AND OPERATING CHARACTERISTICS OF COMPOSITE SUPERCONDUCTORS

Patent No. : 3,428,891

Issued : 02/18/69

Inventor(s) : J. R. Purcell and J. M. Brooks

This patent relates to a method for evaluating the stability of composite superconductors and comprises passing a variable current through a short sample of the composite superconductor wherein the superconductor has been made discontinuous and measuring the voltage drop along the coating of the composite superconductor from one side of the discontinuity.

## VALVE ASSEMBLY

Patent No. : 3,510,102

Issued : 05/05/70

Inventor(s) : Z. F. Sungaila

This patent relates to a valve assembly for use with a liquified-gas container. The assembly enters the container through an opening in the top and has a valve portion proper near the bottom and a control for the valve portion outside the top of the container. The valve assembly serves as an insulated stopper for the container.

## DIRECT-CURRENT GENERATOR FOR SUPERCONDUCTING CIRCUITS

Patent No. : 3,593,110

Issued : 07/13/71

Inventor(s) : R. P. Huebener

This patent relates to a D-C generator for a superconducting circuit and includes a thermoelectric-material member with superconductors connected across the member and the superconducting circuit. A heater attached to one end of the thermoelectric member creates a potential gradient along the member while the member is subject to an environmental temperature which maintains the superconductors in a superconducting state.

## MICROSTABILIZED SUPERCONDUCTOR

Patent No. : 3,600,281

Issued : 08/17/71

Inventor(s) : W. H. Bergmann

This patent relates to a microstabilized superconductor which comprises a superconducting material of the hard Type II series sized in cross sectional area less than 1000 times the coherence length of the material.

## LARGE VOLUME PLANAR PAIR Ge(Li) DETECTOR

Patent No. : 3,612,869

Issued : 10/12/71

Inventor(s) : J. J. Baum and H. W. Helenberg

This patent relates to a holder for a lithium drifted germanium detector of the planar type. The holder includes a heat sink with two spaced apart supporting arms extending from the heat sink. Each of the supporting arms has a flat surface at right angles to the heat sink and the detector is clamped between the flat surfaces. This structure provides equal length thermal paths from both sides of the detector to the heat sink to provide equal cooling to both sections of the detector.

## METHOD OF DETERMINING BONDING IN A COMPOSITE SUPERCONDUCTOR

Patent No. : 3,621,386

Issued : 11/16/71

Inventor(s) : J. R. Purcell

This patent relates to a method for measuring bond quality between a superconductor and a coating thereabout of normal material having high electrical conductivity at superconducting temperatures and comprises interrupting the electrical continuity of the superconductor and cooling the superconductor and coating to a temperature to cause the superconductor to assume a superconducting state. A current of known value is applied to the superconductor and the voltage drop along the coating on both sides of the electrical discontinuity is measured to provide a measure of bond quality.

## CRYOGENIC SENSING DEVICE USING URANIUM MONOPHOSPHIDE - URANIUM MONOSULPHIDE

Patent No. : 3,646,813

Issued : 03/07/72

Inventor(s) : M. Kuznietz, G. H. Lander, Y. Baskin

This patent relates to a sensor which senses one of temperature and magnetic field and comprises a solid solution having a composition  $UP_{1-x}S_x$  where  $x = 0.2$  to  $0.3$  and means for coupling the material to the magnetic field and temperature. Means are provided for varying one of the temperature and magnetic field and for measuring the magnetization of the solid solution responsive to the varied one of the temperature and magnetic field. The measure of the magnetization of the solid solution is a measure of the other of the temperature and magnetic field.

## METHOD AND MEANS FOR CHARGING OR DISCHARGING SUPERCONDUCTOR WINDINGS

Patent No. : 3,667,029

Issued : 05/30/72

Inventor(s) : W. H. Bergmann

This patent relates to charging a winding of superconducting material by electrically shorting the winding with a hard Type-II series superconducting material and cooling the winding and shorting material to a superconducting temperature. A magnetic flux is generated to penetrate the shorting material to establish therein fluxoids and a temperature gradient is established across the shorting material to cause motion of the fluxoids across the shorting material into the magnetic circuit of the windings to effect charging or discharging thereof.

## ----- ELECTRONICS AND ELECTRICAL ENGINEERING -----

## ADDER CIRCUIT

Patent No. : 2,869,786

Issued : 01/20/59

Inventor(s) : D. H. Jacobsohn and L. C. Merrill

This patent relates to an improved parallel addition unit especially adapted for use in electronic digital computers and characterized by propagation of the carry signal through each of a plurality of denominationally ordered stages within a minimum time interval. In its broadest aspects, the invention incorporates a fast multistage parallel digital adder including a plurality of adder circuits, carry-propagation circuit means in all but the most significant digit stage, means for conditioning each carry-propagation circuit during the time period in which information is placed into the adder circuits, and means coupling carry-generation portions of the adder circuit to the carry-propagating means.



## THERMAL COUPLE FOR MEASURING TEMPERATURE IN A REACTOR

Patent No. : 2,914,594 (See Nuclear Related Technology)

## LINEAR SELSYN OR SYNCRO-TRANSMITTER

Patent No. : 2,988,697 Issued : 06/13/61 Inventor(s) : A. Hirsch

This patent relates to an apparatus for determining the position of a member movable axially within a closed tube without perforating the tube. A magnetic core which is short with respect to the length of the member is mounted thereto. A coil and a plurality of windings are disposed axillary outside of the tube and have a total uniform circumferential progression of 360 mechanical degrees or a multiple thereof relative to each other as they extend the length of said tube. The coil and windings are electrically excited whereby axial movement of the magnetic core induces therein voltages having magnitudes or phase angles proportional to the axial position of the magnetic core within the closed tube. Detecting means are provided for reading the magnitudes or phase angles of these voltages and hence the position of the movable member within the closed tube.

## A POSITIONAL DATA SYSTEM

Patent No. : 3,105,189 Issued : 09/24/63 Inventor(s) : G. A. Forster

This patent relates to an apparatus for obtaining a positional error signal between master and slave synchros. A three-phase A-C power source is connected to the stators of the synchros and an error detector is connected to the rotors of the synchros to measure the phasor difference therebetween. A phase shift network shifts the phase of one of the rotors 90 degrees and a demodulator responsive thereto causes the phasor difference signal of the rotors to shift phase 180 degrees whenever the 90 degrees phase shifted signal goes negative. The phase shifted difference signal has a waveform which, with the addition of small values of resistance and capacitance, gives a substantially pure D-C out put whose amplitude and polarity is proportional to the magnitude and direction of the difference in the angular positions of the synchro's rotors.

## THREE STATE MEMORY DEVICE

Patent No. : 3,176,154 Issued : 03/30/65 Inventor(s) : F. O. Salter

This patent relates to a three state memory device. The device comprises a tunnel diode having an inductance connected in series therewith. The input and output of the device are taken across the series-connected diode and inductance. The inductance has a value to permit the diode to oscillate in the negative resistance portion of the characteristic curve thereof, whereby the output of the device is caused to have a characteristic curve with three positive slopes therein. Means are provided for operating the device on each of the positive slopes of the characteristic curve of the device responsive to predetermined input voltages thereto.

## SCANNING ELECTRON MICROSCOPE

Patent No. : 3,191,028 Issued : 06/22/65 Inventor(s) : A. V. Crewe

This patent relates to a new type of scanning electron microscope. The microscope comprises a point source of monoenergetic electrons with means for focusing the electrons into a spot on a specimen. Means are provided for raster scanning the focused electron spot over the specimen and a momentum analyzer is adapted to separate electrons transmitted through the specimen into discrete energy levels. A scintillation detector is positioned to detect the separated electrons at a discrete energy level thereof and a cathode ray tube, having the X and Y sweeps thereof synchronized with the raster sweep scan of the electron spot, is connected to the detector so that the display intensity of the cathode ray tube is responsive to the output of the detector.

## HOMOPOLAR GENERATOR

Patent No. : 3,217,199 Issued : 11/09/65 Inventor(s) : E. E. Musset

This patent relates to means for increasing the power capacity and efficiency of homopolar generators. A plurality of axially spaced rings of nonmagnetic material are embedded in the cylindrical periphery of the rotor of a homopolar machine so as to be in electrical contact therewith along the active portion thereof.

## MAGNET COIL HAVING COOLING MEANS

Patent No. : 3,295,082 Issued : 12/27/66 Inventor(s) : R. L. Kustom and G. E. Yurka

This patent relates to a magnet coil having passages therein for coolant. The magnet is constructed of a pair of coiled copper strips spaced from one another by a large number of spaced cross pieces of insulating material. The successive turns of the copper strips are spaced from one another by a coiled insulating sheet. Coolant flows back and forth across the coiled copper strips in the spaces between the cross pieces. Headers applied to opposite sides of the coil enable the coolant to flow about the coiled strips as it flows across them.

## DEVICE FOR SUPERREGULATION OF AN AMPLIFIER-DISCRIMINATOR CIRCUIT

Patent No. : 3,312,908 Issued : 04/04/67 Inventor(s) : K. G. Porges and J. A. Bjorkland

This patent relates to a device for superregulation of an amplifier-discriminator circuit. The device comprises means for generating pulses alternately having values above and below the threshold of the discriminator circuit to be regulated. Means are provided for applying these pulses to the amplifier-discriminator circuit and for detecting which of the applied pulses are transmitted through the amplifier-discriminator circuit. The detected pulses indicate drift of the amplifier-discriminator circuit. Means are also provided responsive to the detecting means for adjusting the gain of the amplifier-discriminator circuit in accordance therewith.

## UNIVIBRATOR CIRCUIT FOR DETECTING THE TIME OCCURENCE OF INPUT PULSES THERETO

Patent No. : 3,319,083 Issued : 05/09/67 Inventor(s) : M. G. Strauss

This patent relates to circuits for detecting the time occurrence of pulses. The invention comprises adding a singletstage transistor amplifier to a transistor univibrator to detect the time occurrence of input pulses applied thereto.



## HIGH-VOLTAGE GENERATOR

Patent No. : 3,360,663

Issued : 12/26/67

Inventor(s) : A. V. Crewe, A. Yokosawa and D. J. DeGeeter

In general, this patent relates to high-voltage generators. A Faraday cup is mounted in electrical connection with one of two electrodes spatially disposed with respect to each other in a partial vacuum. Means are provided for generating and directing an electron beam into the Faraday cup, whereby a negative charge accumulation occurs on the electrode having the Faraday cup attached thereto and a high voltage is developed between the two electrodes.

## ELECTRICAL GENERATOR

Patent No. : 3,372,290

Issued : 03/05/68

Inventor(s) : E. S. Sowa and C. J. Divona

This patent relates to an apparatus for generating electricity from a high-velocity vapor jet. The apparatus comprises means for generating a stationary shock wave in a high-velocity vapor jet to ionize the vapor passing through the shock wave. A first electrode is mounted downstream from the shock wave to collect electrons contained in the ionized vapor jet. A second electrode is mounted further downstream from the shock wave to collect the residual positive charge in the ionized vapor jet, whereby an electrical potential is generated between the first and second electrodes.

## FAST VERTICAL STROKE MOVING COIL TRANSDUCER

Patent No. : 3,374,409

Issued : 03/19/68

Inventor(s) : A. J. Gorka

This patent relates to an apparatus for periodically producing a fast vertical stroke and includes an armature held by a spring at the top of the desired stroke. The armature consists of an electrical conductor wound into a number of rectangular loops. The lower portion of the armature is located in a uniform magnetic field which induces a downward motion in the armature when it is pulsed with an electrical current circulating in the proper direction around the conductor loops. The current in the upper portion of the loop reverses direction with respect to the magnetic field, and the armature experiences a decelerating or upward force as its lower portion passes out of the field and its upper portion enters the field. The armature reaches the bottom of its stroke while approaching zero velocity, and it is returned to its rest position under action of the spring.

## METHOD OF CALIBRATING HIGH-VOLTAGE PRECISION RESISTANCE POTENTIAL DIVIDERS

Patent No. : 3,377,355

Issued : 04/09/68

Inventor(s) : R. N. Lewis

This patent relates to a method of in-circuit calibration of a precision resistance potential divider having a plurality of resistance arms. The method comprises series connecting a first resistance and a calibration potentiometer and connecting the resistance-potentiometer combination across the divider. A null-indicating device is connected across the output of the divider and the wiper arm of the potentiometer. The wiper arm of the potentiometer is adjusted until the indicating device reads a null value. Shorting is then effected across the resistance arm of the divider adjacent the output thereof and the wiper arm of the potentiometer is adjusted until the null-indicating device again reads a null value therefor. The resistance arm short is then removed and the nonoutput connected terminal of the resistance arm of the divider adjacent the output thereof is connected to the common terminal of the resistance-potentiometer combination. The wiper arm of the potentiometer is adjusted until the indicating device again reads a null value therefor. The terminal connection is then removed and calculation of the division ratio of the divider is effected from the potentiometer settings required to obtain the aforesaid null values, whereby the divider is calibrated.

## ANTILOGARITHMIC FUNCTION GENERATOR

Patent No. : 3,439,187

Issued : 04/15/69

Inventor(s) : M. G. Strauss

This patent relates to an antilogarithmic function generator for an input logarithmic pulse and comprises a first triode transistor having an electrically grounded emitter and the input logarithmic pulse applied to the base of the transistor. The output of the transistor is taken from the collector to provide a signal proportional to the antilogarithm of the input pulse. Means are provided for generating a quiescent reference first current and applying it to the collector of the transistor. Means are also provided for generating a second reference current equal to the quiescent value of the first current and generating a signal proportional to the difference in value between the first and second currents. Means are provided responsive to the generated difference signal for regulating in the absence of the input logarithmic pulse the value of the first current and for generating a third current equal to the quiescent value of the first current, which third current is applied to the collector of the transistor in the presence of the input logarithmic pulse.

## HIGH VOLTAGE PULSING APPARATUS FOR A SPARK CHAMBER

Patent No. : 3,447,032

(See Selected Nuclear Related Technology)

## HIGH-FREQUENCY, WIDE-BAND TRANSFORMER

Patent No. : 3,453,574

Issued : 07/01/69

Inventor(s) : T. de Parry

This patent relates to a transformer comprising a toroidal core and first and second like coaxial cables each spirally wound in the same directional sense around the periphery of an associated portion of said toroidal core. The outer conductors of the coaxial cables are sectionally discontinuous, while the inner and outer conductors of the cables form windings of the transformer. Means are provided for electrically grounding one pair of adjacent ends of the inner conductors of the cables, while the other pair of adjacent ends of the inner conductors form terminals to the transformer windings. One pair of adjacent ends of the outer conductors of the cables and alternate related ends therefrom of the discontinuous sections of the outer conductors are electrically grounded. The other pair of adjacent ends of the outer conductors of the cables form terminals to the transformer windings. Means are provided for connecting to an associated one of the other pair of adjacent ends of the other conductors alternate related ends therefrom of the discontinuous sections of the outer conductors.

## ELECTRON PULSE GENERATOR OF THE GROUNDED GRID TYPE EMPLOYING A DELAY LINE STORAGE MEANS

Patent No. : 3,457,517

Issued : 07/22/69

Inventor(s) : K. W. Johnson, T. E. Klippert, and  
W. J. Ramler

This patent relates to a pulsed electron source comprising an electron gun including an anode, a cathode and a grid. Means are provided to electrically bias the anode and grid of the electron gun. A coaxial cable is charged to a predetermined voltage and coaxial switching means transfer the charge on the coaxial cable to the cathode of the electron gun.

## METHOD OF ENCODING BINARY DIGITAL DATA

Patent No. : 3,461,237

Issued : 08/12/69

Inventor(s) : F. O. Salter

This patent describes a method of encoding successive digits of a binary sequence into a sequence of two voltage levels which have one of two time durations depending upon the binary values of successive digits.

## ELECTRICAL CONNECTOR FOR USE IN LIQUID METAL

Patent No. : 3,471,826

Issued : 10/07/69

Inventor(s) : E. Hutter and H. H. Hooker

This patent relates to an electrical socket for multiple connections which may be subjected to immersion in sodium coolant. Provision is made for leak-proofing the socket together with a backup safety trap for a minor amount of sodium which is kept from electrical connections by a slight internal positive pressure of argon.

## LOGARITHMIC FUNCTION GENERATOR

Patent No. : 3,480,793

Issued : 11/25/69

Inventor(s) : M. G. Strauss

This patent relates to a logarithmic function generator including a voltage-to-current converter which changes an applied input voltage pulse to a current pulse. Means are provided to generate an electrical signal responsive to the occurrence of the applied input voltage pulse. A linear gate responsive to the generated electrical signal couples the current pulse to a logarithmic function generator comprising an operational amplifier having a transistor as a feedback element therein. The output of the operational amplifier, the emitter-base voltage of the transistor, is proportional to the logarithm of the applied input voltage pulse.

## PHANTASTRON DRIVE FOR IGNITRONS

Patent No. : 3,482,144

Issued : 12/02/69

Inventor(s) : T. T. Anderson

This patent relates to an apparatus for controlling the firing time of an ignitron having an A-C supply where a pulse-forming circuit generates pulses synchronized with the A-C supply. A phantastron circuit driven by these pulses provides pulses precisely regulated in time to control the time of firing of the ignitron.

## PULSE STRETCHING CIRCUIT

Patent No. : 3,510,691

Issued : 05/05/70

Inventor(s) : R. N. Larsen

This patent relates to a pulse-stretching circuit including a capacitive differentiator to convert an applied voltage pulse to a current pulse. A diode switching circuit applies the current pulse to a storage capacitor to provide thereacross a voltage pulse having a duration determined by the discharge rate of the storage capacitor and a value which is the integral of the current pulse.

## DIGITAL FILTER FOR SUPPRESSING NONSTATISTICAL NOISE BURSTS IN DIGITAL AVERAGING

Patent No. : 3,518,414

Issued : 06/30/70

Inventor(s) : L. S. Goodman and F. O. Salter

This patent relates to a device for suppressing fluctuations in the number of pulses in successive trains of pulses which are outside of predetermined statistically expected limits by means of a comparison circuit which detects the difference between the average number of pulses in a train of pulses during a predetermined time duration and the number of pulses in the succeeding train of pulses during the same predetermined time duration.

## METER FOR MEASURING RMS VALUES OF PULSED CURRENT SIGNALS

Patent No. : 3,521,165

Issued : 07/21/70

Inventor(s) : A. T. Visser

This patent relates to a pulsed signal rms meter which includes, connected across the signal, a resistor which is temperature-sensitive to the rms value of the pulsed signal and has a thermal time constant greater than the time separation of the pulsed signals to remain relatively insensitive thereto. Thermocouples monitor the temperature of the resistor and provide an output which, when recorded, is a measure of the rms value of the applied pulsed signal.

## PLASMA TUNING MEANS WHEREIN THE RESONANT FREQUENCY OF A CAVITY RESONATOR TRACKS THE FREQUENCY OF AN IONIZING CONTROL FREQUENCY

Patent No. : 3,525,953

Issued : 08/25/70

Inventor(s) : S. L. Halverson

This patent relates to an apparatus for varying the resonant frequency of a cavity. A variable-frequency signal generator is electrically coupled to a resonant cavity containing an ionized gas. The resonant frequency of the cavity may be changed by varying the frequency of the electrically coupled signal.

## RATEMETER WITH AUTOMATIC DEAD-TIME CORRECTION

Patent No. : 3,573,639

Issued : 04/06/71

Inventor(s) : A. J. Metz and R. H. Howard

This patent relates to an apparatus which operates on the output random-width-pulse train from a signal handling system and includes means for generating a first signal proportional to the ratio of the summed time intervals between the pulses in said train to the total time of the train. Means also are provided for generating a second signal which is proportional to the ratio of the pulse repetition rate of the pulses in said output pulse train to said first signal, which signal is proportional to the true pulse rate of the random-pulse train input to the signal handling system.

## FLEXIBLE STRIPLINE TRANSMISSION LINE

Patent No. : 3,586,757

Issued : 06/22/71

Inventor(s) : M. Haldeman, Jr.

A stripline transmission line is constructed so that the individual conducting and insulating portions of the stripline are free to move relative to each other. This form of construction permits the stripline to be bent to a very small radius without distortion or degradation of its electrical characteristics.

## PULSE TRANSFORMER USING STRIPLINE WINDINGS

Patent No. : 3,611,233

Issued : 10/05/71

Inventor(s) : M. Haldeman, Jr.

This patent relates to a pulse transformer and to the use of a stripline to form the windings. In order to achieve symmetry and minimize reflections, the stripline is twisted at predetermined points in the winding so that the position of the stripline conductors relative to the core is changed. In one embodiment the stripline is twisted 180° each time it passes through the center of a toroidal core.

## DIGITAL PLOTTING DEVICE

Patent No. : 3,624,370

Issued : 11/30/71

Inventor(s) : J. Gray, Jr.

This patent relates to a digital plotting device which receives information in a digital form. The digital information has a most significant figure and at least one subsequent significant figure. The plotter includes a plurality of printing hammers positioned opposite recording paper. A driving mechanism positions the plurality of hammers in response to the subsequent significant digits and actuates a particular hammer in response to the most significant digit. The actuated printing hammer marks the recording paper in the desired location.

## CONTINUOUS DIGITAL RATEMETER

Patent No. : 3,646,330

Issued : 02/29/72

Inventor(s) : S. J. Rudnick, P. L. Michaud, and  
K. G. Porges

This patent relates to a continuous ratemeter having a digital output. The ratemeter receives random input pulses and develops an output signal representative of the input pulse rate. A derandomizer is used to reduce errors if more than one input pulse is received during the clock period. A delayed replica of the input pulse train is available for analysis if required.

## TELEMONITORING SYSTEM

Patent No. : 3,678,512

Issued : 07/18/72

Inventor(s) : R. W. Fergus

This patent relates to a multistation monitoring system interconnected by a single two conductor cable. Pulses are transmitted over the cable by a signal generator. Each station connected to the cable counts the pulses and upon receipt of the appropriate pulse each station changes the pulse width according to the data to be transmitted. Provision is also made to transmit control pulses which can be used to activate controls at remote locations.

## RANDOM NUMBER GENERATOR

Patent No. : 3,706,941

Issued : 12/19/72

Inventor(s) : C. E. Cohn

This patent relates to a physical noise source which is used to develop a first random sequence of bits. A second random sequence of bits is formed from the first sequence by comparing the bits in each pair of bits of first sequence to develop a corresponding bit in the second sequence according to the relationship between the bits in the pairs of bits. Every other bit of the second sequence is complemented to form a sequence of random numbers. The random numbers can be combined to form words.

## DIGITAL SUBTRACTION DEVICE

Patent No. : 3,725,688

Issued : 04/03/73

Inventor(s) : G. S. Brunson, R. N. Curran and  
F. H. Just

This patent relates to a circuit which acts to subtract a first series of pulses from a second series of pulses. The second series of pulses is coupled directly to an output terminal of the circuit until a first series pulse is counted in one direction by an up-down counter. With a count greater than zero in the up-down counter, the second series of pulses is coupled thereto to count in the opposite direction. With the up-down counter having a count greater than zero, the second series of pulses are also blocked from the output terminal of the subtraction device.

## COUNTER FOR RADIATION MONITORING

Patent No. : 3,732,422

Issued : 05/08/73

Inventor(s) : G. S. Brunson, R. N. Curran and  
F. H. Just

This patent relates to a radiation counter which repeatedly takes periodic samples by counting radiation pulses which are received during a predetermined period. The predetermined period is measured by a timing circuit. An amplitude measuring circuit measures the amplitude of the incoming radiation pulses and acts to disable the timing circuit whenever a radiation pulse above a particular amplitude is received. By disabling the timing circuit, dead time, during which the counting circuit will not detect radiation pulses, is not counted as part of the predetermined counting period.

## ACTIVE CROWBAR FOR A SWITCHING MAGNET

Patent No. : 3,777,176

Issued : 12/04/73

Inventor(s) : W. F. Praeg

This patent relates to a first electrical source which is connected to an electromagnet by silicon-controlled rectifiers (SCR's) to produce a rapid rise in current in the load. A second electrical source is then connected by SCR's to the load and the first is disconnected to produce a constant current in the load. A connection is then established to discharge the stored energy from the electromagnet, producing a rapid drop in current, and the second source is disconnected. The stored energy may be returned to the first electrical source.



## REDUCING GAIN SHIFTS IN PHOTOMULTIPLIER TUBES

Serial No. : 517,678

Filed : 10/24/74

Inventor(s) : C. E. Cohn

A means is provided for reducing gain shifts in multiplier tubes due to varying event count rates. It includes means for limiting the number of cascaded, active dynodes of the multiplier tube to a predetermined number with the last of a predetermined number of dynodes being the output terminal of the tube. This output is applied to an amplifier to make up for the gain sacrificed by not totally utilizing all available active stages of the tube. Further reduction is obtained by illuminating the predetermined number of dynodes with a light source of such intensity that noise appearing at the output dynode associated with the illumination is negligible.

## ----- ENERGY CONVERSION -----

## HYDROGEN-HYDRIDE CELL

Patent No. : 3,208,883

Issued : 09/28/65

Inventor(s) : C. E. Crouthamel and R. R. Heinrich

This patent relates to a fuel cell of the hydrogen-hydride type having a metal anode, a fused salt electrolyte and a hydrogen-diffusing cathode. Included is an alpha radiation source located on the gas side of the hydrogen-diffusing cathode.

## REGENERATION OF EMF CELLS HAVING MOLTEN METAL ELECTRODES AND A FUSED SALT ELECTROLYTE

Patent No. : 3,238,437

Issued : 03/01/66

Inventor(s) : M. S. Foster and C. E. Crouthamel

This patent relates to a method of regenerating an emf cell having dissimilar molten metal electrodes separated by a molten salt electrolyte wherein the temperature of the cell is raised substantially above the melting points of the molten components and a D. C. voltage is applied in series opposition to the cell. The applied voltage required for regeneration is substantially less than the output voltage of an operating cell.

## CATHODIC HYDROGEN CELL AND METHOD OF MAKING

Patent No. : 3,338,749

Issued : 08/29/67

Inventor(s) : C. E. Johnson, R. R. Heinrich and  
C. E. Crouthamel

This patent relates to a method of increasing the efficiency of a fuel cell including a metal anode, a hydrogen cathode, a fused salt electrolyte and a vanadium diaphragm consisting of purifying the fused salt electrolyte to remove water of crystallization and oxygen therefrom before use of the electrolyte.

## MAGNETOHYDRODYNAMIC GENERATOR

Patent No. : 3,414,744

Issued : 12/03/68

Inventor(s) : M. Petrick

This patent relates to a magnetohydrodynamic generator which includes an elongated duct having a flat side, a magnet which establishes a magnetic field through the duct, and means for collecting the electric current generated. The generator also includes means for directing a liquid metal onto the flat plate at an angle of between 3° and 12° and for causing the liquid metal to flow rapidly along the plate as a thin film.

## SEAL

Patent No. : 3,419,432

Issued : 12/31/68

Inventor(s) : J. C. Hesson

This patent relates to a regenerating EMF cell having two molten metals separated by a molten fused salt electrolyte which is contained in a pair of complementary housings with a pair of flanges having a thin portion adjacent the housing and a thick portion spaced from the housing. A ceramic insulating ring is located between the thin portions of the flanges and a rubber gasket is located between the thick portions of the flanges. Any molten salt which flows between the thin portions of the flanges is frozen because of heat loss through the flanges and does not continuously corrode the insulating rings.

## ELECTROCHEMICAL CELL

Patent No. : 3,488,221

Issued : 01/06/70

Inventor(s) : H. Shimotake, C. E. Johnson, M. S. Foster,  
and E. J. Cairns

This patent relates to an electrochemical power-producing cell comprised of an alkali metal anode and an electronegative cathode separated by a fused salt electrolyte. The anode current collector is spirally shaped and the cathode current collector may contain metal filings, turnings, surfaces or the like.

## SECONDARY POWER-PRODUCING CELL

Patent No. : 3,531,324

Issued : 09/29/70

Inventor(s) : A. K. Fischer, V. A. Maroni, A. D. Tevebaugh,  
and E. J. Cairns

This patent relates to a secondary power-producing cell including a liquid-lithium-metal anode, a fused-salt electrolyte containing ions of the anode metal and a cathode consisting of a mixture of 4 parts of phosphorus and between 3 and 10 parts of sulfur in the liquid state in atomic weight proportions between that of  $P_4S_3$  and  $P_4S_{10}$ .

## SECONDARY POWER-PRODUCING CELL

Patent No. : 3,615,828

Issued : 10/26/71

Inventor(s) : A. K. Fischer

This patent relates to a secondary power-producing cell which consists of an anode and a cathode formed of binary compounds containing the same two elements in different stoichiometric proportions, the electronegative component thereof being distillable, and an electrolyte that contains ions of the element that is to be transported through it separating the electrodes. Regeneration is by distillation of the electronegative component from the cathode to the anode to reverse polarity of the cell.

## MAGNETOHYDRODYNAMIC METHOD AND SYSTEM

Patent No. : 3,636,389

Issued : 01/18/72

Inventor(s) : M. Petrick

This patent relates to a magnetohydrodynamic (MHD) power plant containing a plurality of MHD generators arranged in a number of stages which operates on a two-phase working fluid consisting of an inert gas dispersed in an electrically conductive liquid. Heat is added to the working fluid by reconstituting the working fluid with conductive liquid heated to the original temperature between stages. All stages are operated essentially isothermally, the last MHD generator being operated under conditions such that vapors of the conductive liquid present in the working fluid are condensed therein. The gas phase from the last MHD generator is cooled by regenerative heat exchange and recompressed prior to being returned to the heat source. Also, each MHD generator is surrounded by a separate magnetic field which is separately adjustable to minimize the velocity difference between phases as the working fluid passes through the MHD generator.

## ELECTROCHEMICAL POWER-PRODUCING CELL

Patent No. : 3,666,560

Issued : 05/30/72

Inventor(s) : E. J. Cairns, A. A. Chilenskas,  
H. Shimotake and R. K. Steunenberg

This patent relates to an electrochemical power-producing cell comprising a molten lithium metal anode in contact with an anode current collector, a molten selenium metal cathode disposed in a cathode cup and in contact with a single layer expanded metal cathode current collector having a corrugated shape, both surfaces of said corrugated current collector being in contact with the molten selenium and the interior of said cathode cup defining the perimeter of said current collector, and a fused salt electrolyte containing a finely divided inert ceramic filler in the form of a paste disk separating said anode and cathode, said corrugated cathode current collector being coextensive with and having its corrugation ridges on one side in contact with said electrolyte paste disk.

## CATHODES FOR SECONDARY ELECTROCHEMICAL POWER-PRODUCING CELLS

Patent No. : 3,716,409

Issued : 02/13/73

Inventor(s) : E. J. Cairns, M. L. Kyle and H. Shimotake

This invention comprises a secondary electrochemical power-producing cell including an anode containing lithium, an electrolyte containing lithium ions and a cathode containing sulfur wherein the cathode comprises plates of a porous substrate material impregnated with sulfur alternating with layers, which may also comprise porous substrate plates, containing electrolyte. The cathode may further be encased in additional electrolyte-impregnated porous material. The cathode may also comprise a metal housing having an orifice at one end, a plate of porous substrate material impregnated with sulfur sealing the orifice, and a layer of electrolyte-impregnated porous substrate material mounted on the exterior surface of the sulfur-impregnated plate, liquid sulfur being located within the housing enclosure.

## IMPLANTABLE BATTERY

Patent No. : 3,823,037

Issued : 07/09/74

Inventor(s) : E. J. Cairns, A. A. Chilenskas and  
H. Shimotake

This patent relates to an implantable secondary electrochemical battery capable of use as a power source for an artificial heart. The battery includes an enclosed, evacuated cylindrical inner housing securely supported within an enclosed, evacuated cylindrical outer housing with a plurality of sealed, high-temperature secondary electrochemical cells immobilized within the inner housing and electrically connected in series.

## HOMOGENEOUS CATHODE MIXTURES FOR SECONDARY ELECTROCHEMICAL POWER-PRODUCING CELLS

Patent No. : 3,827,910

Issued : 08/06/74

Inventor(s) : E. J. Cairns, H. Shimotake, and J. R. Selman

This patent relates to a secondary, electrochemical power-producing cell having an anode containing a molten alkali metal of low electronegativity, an electrolyte containing alkali-metal ions, and a novel cathode containing a reactant comprising a chalcogen wherein the cathode comprises a substantially homogeneous mixture of the reactant, a porous substrate material impregnable by the reactant, electrolyte, and an electronically-conducting material.

## SECONDARY ELECTROCHEMICAL CELLS WITH A CHALCOGEN CATHODE

Patent No. : 3,833,421

Issued : 09/03/74

Inventor(s) : R. J. Rubischko, E. J. Cairns, and  
R. K. Steunenberg

This patent relates to a novel cathode and a novel method for making such cathode, for use in a secondary electrochemical power-producing cell having an anode containing a molten alkali-metal of low electronegativity, an electrolyte containing alkali-metal ions, and a cathode containing a reactant comprising a chalcogen. The cathode comprises a solid, porous substrate structure, impregnable by the reactant, having interconnected pores. These interconnected pores have their interior surfaces partially coated with a layer of electronically-conducting metal wettable by the electrolyte and are filled with both the electrolyte and the chalcogen-containing reactant.



## TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC (MHD) GENERATOR

Patent No. : 3,878,410

Issued : 04/15/75

Inventor(s) : M. Petrick, J. C. Cutting, W. E. Amend,  
and R. L. Cole

This invention relates to the elimination of dissipative boundary layer electrical shunts in a two-phase liquid-metal magnetohydrodynamic (MHD) generator. The slow moving, conducting liquid boundary layer adjacent the insulating walls of the generator is displaced by injecting an inert gas into the generator channel in the direction of flow of the working fluid through the insulating walls at several locations through a narrow slit extending across the insulating walls.

## SECONDARY ELECTROCHEMICAL POWER-PRODUCING CELLS HAVING MIXED CATHODE COMPOSITION

Patent No. : 3,884,715

Issued : 05/20/75

Inventor(s) : E. C. Gay, H. Shimotake, E. J. Cairns,  
and W. J. Walsh

This patent relates to a secondary electrochemical power-producing cell including an anode containing a molten alkali metal of low electronegativity, an electrolyte containing alkali-metal ions and a cathode containing a mixture of a chalcogen and a component which reduces the activity of said chalcogen in the electrolyte. This component, for example As, inhibits transfer of the chalcogen from the cathode to the anode and increases the cell life.

## MODULAR ELECTROCHEMICAL CELL

Patent No. : 3,887,396

Issued : 06/03/75

Inventor(s) : W. J. Walsh, A. A. Chilenskas, E. J. Cairns  
and P. A. Nelson

This patent relates to a high-temperature, alkali-metal/chalcogen electrochemical cell including a porous cathode interposed between two porous anodes within a disk-shaped housing. The electrodes are electrically separated by a cloth of insulative material and current flow is provided through a molten electrolyte which permeates the cloth. Electrical terminals from the cathode and the anode extend axially from opposite surfaces of the housing and are of mating prong and socket construction to permit stacking of a plurality of cells in electrical series.

## METHOD AND MEANS OF GENERATING POWER FROM FOSSIL FUELS WITH A COMBINED PLASMA AND LIQUID-METAL MHD CYCLE

Patent No. : 3,895,243

Issued : 07/15/75

Inventor(s) : W. E. Amend and J. C. Cutting

This patent describes the heat required for operation of a two-phase liquid-metal MHD generator obtained from the waste heat of a plasma MHD generator. The liquid metal is heated by passing it in heat exchange relationship to the combustion mixture exhausted from the plasma MHD generator and the inert gas is heated by cooling the walls of the combustion chamber and plasma MHD generator.

## CATHODE FOR A SECONDARY ELECTROCHEMICAL CELL

Patent No. : 3,907,589

Issued : 09/23/75

Inventor(s) : E. C. Gay and F. J. Martino

In a secondary electrochemical cell including an alkali metal reactant in the anode, a cathode composition including a chalcogen reactant in the cathode and an electrolyte containing ions of said alkali metal, the improvement wherein said cathode composition comprises; at least one transition metal sulfide and a sulfide reaction product of said alkali metal and said transition metal sulfide, the total atomic concentration of sulfur combined with said transition metal and said alkali metal reactant within said cathode being in stoichiometric excess of the total atomic concentration of said transition metal. A method of preparing a cathode for use in a secondary electrochemical cell wherein said cell includes a cathode structure with inner chamber, an anode with an alkali metal reactant, and an electrolyte including ions of said alkali metal in contact with both of said electrodes, the improvement comprising: (a) blending particulate transition metal sulfide, sulfide reaction product of said anode reactant and said transition metal sulfide, molten electrolyte and particles of electrically conductive material to form a cathode composition; and (b) assembling said cathode composition into said cathode structure of said electrochemical cell for use as a source of electrical power.

## RADIANT ENERGY COLLECTOR

Serial No. : 492,074

Filed : 07/26/74

Inventor(s) : R. Winston

An electromagnetic (including solar) energy collection device is provided which does not require a solar tracking capability. It includes an energy receiver positioned between two side walls which reflect substantially all incident energy received over a predetermined included angle directly onto the energy receiver.

# ----- MEASUREMENTS AND CONTROLS -----

## METHOD OF TESTING HERMETIC CONTAINERS

Patent No. : 2,873,603

Issued : 02/17/59

Inventor(s) : L. B. Borst

This patent deals with a method for testing hermetic containers enclosing a material capable of chemically combining with a fluid at elevated temperatures. In accordance with the invention, the container to be tested is weighed together with the material therein. The container and its contents are then immersed in the fluid and heated to a temperature sufficiently high to cause a reaction to take place between the contents and the fluid and maintained under such conditions for a definite period of time. The container and its contents are then cooled and re-weighed. The rate of change in weight is determined and utilized as an index to determine the possibility of container failure.

## CONTROL LIMITER DEVICE

Patent No. : 2,927,070

Issued : 03/01/60

Inventor(s) : J. A. DeShong

This patent relates to a control limiting device for monitoring a control system. The system comprises a condition sensing device, a condition varying device exerting a control over the condition and a control means to actuate the condition varying device. A control limiting device integrates the total movement or other change of the condition varying device over any interval of time during a continuum of overlapping periods of time, and if the total movement or change of the condition varying device exceeds a preset value, the control limiting device will switch the control of the operated apparatus from automatic to manual control.

## METAL RESISTIVITY MEASURING DEVICE

Patent No. : 2,965,840

Issued : 12/20/60

Inventor(s) : C. J. Renken, Jr. and R. G. Myers

This patent relates to an eddy current device for detecting discontinuities in metal samples. Alternate short and long duration pulses are inductively applied to a metal sample via the outer coil of a probe. The long pulses give a resultant signal from the metal sample responsive to probe-to-sample spacing and discontinuities within the sample and the short pulses give a resultant signal responsive only to probe-to-sample spacing. The inner coil of the probe detects the two resultant signals and transmits them to a separation network where the two signals are separated. The two separated signals are then transmitted to a compensation network where detected signals due to the short pulses are used to compensate for variations due to probe-to-sample spacing contained in the detected signals from the long pulses. Thus, a resultant signal is obtained responsive to discontinuities within the sample and independent of probe-to-sample spacing.

## DEFLECTION PRESSURE TESTER

Patent No. : 2,966,794

Issued : 01/03/61

Inventor(s) : C. M. Cooper

This patent covers a method and apparatus for determining whether the jacket of a nuclear-fuel slug has a leak. The region of the jacket to be leak-tested is sealed off, and gas under pressure is applied thereto. If there is an imperfection, the gas will enter the jacket thereto and bulge another region of the jacket. The bulge occurring is measured by a gauge.

## NONDESTRUCTIVE EDDY CURRENT TESTING

Patent No. : 2,985,824

Issued : 05/23/61

Inventor(s) : C. J. Renken, Jr.

This patent relates to an eddy current testing device for measuring metal continuity independent of probe-to-sample spacing. An inductance wound test probe is made a leg of a variable impedance bridge and the bridge is balanced with the probe away from the sample. An A-C signal is applied across the input terminals of the bridge circuit. As the probe is brought into proximity with the metal sample, the resulting impedance change in the probe gives an output signal from the bridge whose phase angle is proportional to the sample continuity and amplitude is proportional to the probe-to-sample spacing. The output signal from the bridge is applied to a compensating network where, responsive to amplitude changes from the bridge output signal, a constant phased voltage output is maintained when the sample is continuous regardless of probe-to-sample spacing. A phase meter calibrated to read changes in resistivity of the metal sample measures the phase shift between the output of the compensating network and the original A-C signal applied to the bridge.

## CONTROL FOR ROLLING MILL

Patent No. : 2,988,938

Issued : 06/20/61

Inventor(s) : A. B. Shuck, and W. C. Shaw

This patent covers a plutonium-rolling apparatus having two sets of feed rolls, shaping rolls between the feed rolls, and grippers beyond the feed rolls, which ready a workpiece for a new pass through the shaping rolls by angularly shifting the workpiece about its own axis or transversely moving it on a line parallel to the axes of the shaping rolls. Actuation of each gripper for gripping or releasing the workpiece is produced by the relative positions assumed by the feed rolls of the set adjacent the gripper as the workpiece enters or leaves the feed rolls.

## A POSITIONAL DATA SYSTEM

Patent No. : 3,105,189

(See Electronics and Electrical Engineering)

## FRICTION-FREE BALANCE

Patent No. : 3,123,165

Issued : 03/03/64

Inventor(s) : N. J. Carson, Jr., H. W. Ostrander and C. N. Munter

This patent relates to a weighing device having a load-supporting, vertical shaft buoyed up by mutually repellant magnets. The shaft is aligned by an air bearing and has an air gauge to sense vertical displacement caused by weights placed on the top end of the shaft.

## FORCE LIMITING DEVICE FOR MOTOR CONTROL

Patent No. : 3,145,333

Issued : 08/18/64

Inventor(s) : J. A. Pardini and V. Hutter

This patent covers a manipulator that can transmit no more than a certain net force to an object to be handled to avoid damaging the object, not withstanding a variable background force such as friction against which the manipulator operates. The manipulator includes parts that at the start of operation move relative to one another against a spring and so take a relative position dependent on the background force encountered in the particular operation. When the parts have taken this relative position, a time relay causes a control for a switch carried by one of the parts to become fixed to the other part so that a major disturbance of the said relative position of the manipulator parts causes the switch to be actuated for stopping the manipulator and avoiding damage to the object being handled.

## DEVICE FOR TESTING METAL SHEETS BY MEASURING THE TIME REQUIRED FOR ELECTROMAGNETIC PULSES TO PASS THERE THROUGH

Patent No. : 3,189,817

Issued : 06/15/65

Inventor(s) : C. J. Renken

This patent relates to a device for nondestructively testing conductive metal sheet. The device comprises a first coil mounted on one side of the metal sheet and spaced therefrom and a second coil mounted on the other side of the sheet and spaced therefrom. Means are provided for applying a pulsed signal to one of the coils and for detecting the time delay of the signal received by the other coil due to the presence of the metal sheet.

## SCANNING ELECTRON MICROSCOPE

Patent No. : 3,191,028

(See Electronics &amp; Electrical Engineering)

## PULSED ELECTROMAGNETIC FIELD SYSTEM FOR NONDESTRUCTIVE TESTING

Patent No. : 3,229,197

Issued : 01/11/66

Inventor(s) : C. J. Renken

This patent relates to a nondestructive device for detecting subsurface irregularities in a metal sample. The device comprises a transmitting coil mounted adjacent one side of the metal sample with means for applying alternate long and short duration pulses to the transmitting coil. Means are provided for shielding the transmitting coil to cause only a portion of the pulsed electromagnetic fields resulting from the long and short pulses applied to the transmitting coil to be transmitted therefrom to the metal sample. A receiving coil is mounted adjacent the transmitting coil and aligned to detect the reflected electromagnetic fields from the metal sample due to the transmitted pulsed electromagnetic fields. Means are provided for discriminating from said detected reflected electromagnetic fields the reflected electromagnetic fields caused by subsurface irregularities in the metal sample.

## APPARATUS FOR CONDENSING AND CONTROLLING THE RATE OF CONDENSATION OF AN ELECTRICALLY CONDUCTING LIQUID

Patent No. : 3,344,853

Issued : 10/03/67

Inventor(s) : R. M. Singer

This patent relates to an apparatus for condensing and controlling the rate of condensation of an electrically conducting liquid. A heat exchanger condenses the vapor of an electrically conductive liquid within a chamber having a cooled electrically nonconductive wall capable of being wetted by the vapor. A magnet provides a D-C magnetic field normal to the wall and a D-C voltage supply is connected to apply a voltage to the condensate to induce a current therein and motion thereof in a particular direction.

## RADIOGRAPHIC NONDESTRUCTIVE TESTING METHOD

Patent No. : 3,359,419

Issued : 12/19/67

Inventor(s) : J. Kastner and H. Berger

This patent relates to a method for obtaining a radio-graphic image of a sample. An ionizing-radiation-sensitive water-white thermo-luminescent material is mounted adjacent the sample. A radiation beam is generated and the thermo-luminescent material is exposed thereto via said sample. The thermoluminescent material is then excited to cause luminescence thereof and light released by the thermoluminescent material during luminescence is recorded to give a radiographic image of the sample.

## PULSED NONDESTRUCTIVE EDDY CURRENT TESTING DEVICE USING SHIELDED SPECIMEN ENCIRCLING COILS

Patent No. : 3,361,960

Issued : 01/02/68

Inventor(s) : C. J. Renken, Jr. and A. Sather

This patent relates to nondestructive eddy current testing devices using specimen encircling coils and includes a first solid cylindrical magnetic-field shield having a hollow shaft along the longitudinal axis thereof, one end of the shield being terminated in a frustum. A second hollow cylindrical magnetic-field shield having one end thereof terminated in a frustum is aligned with the first shield along their longitudinal axes with their frustums in juxtaposition to define a narrow aperture between the vertices thereof. A transmitting coil is disposed about the aperture between the frustums of the shields and a receiving coil is disposed around the longitudinal axis of the second shield and mounted in the interior adjacent the sides of the frustum thereof. Means are provided for pulse excitation of the transmitting coil and for detecting signals received by the receiving coil, which signals are a measure of subsurface flaws existing in metal tubing as it passes through the shields along the longitudinal axes thereof.

## PULSED ELECTROMAGNETIC TESTING DEVICE WITH SAMPLING MEANS

Patent No. : 3,443,212

Issued : 05/06/69

Inventor(s) : C. J. Renken

This patent relates to a multiparameter nondestructive electro-magnetic testing device comprising means for transmitting into a specimen a pulsed electromagnetic signal. Means are provided for sampling the amplitude of the reflected electromagnetic pulse from the specimen  $2\tau$  times at a time interval therebetween of  $\frac{1}{W}$ , where  $\tau$  = the time duration of the reflected electromagnetic pulse and  $W$  = the band width of the reflected electromagnetic pulse detection means.



## OPTICAL RANGING DEVICE

Patent No. : 3,515,486

Issued : 06/02/70

Inventor(s) : R. H. Vonderohe, J. H. Doede,  
and C. W. Lindenmeyer

This patent relates to an optical ranging device which comprises means for generating and transmitting a collimated beam of light along a reference line. Flat rotatable mirrors located at specific points on the reference line reflect the light beam to an object point spaced therefrom. A curved mirror at the object point reflects the light beam back to the flat mirrors and then along the reference line. A combination of beam splitters and photomultipliers detect any deviation from the reference line of the light reflected from the object point and the signal therefrom is used to rotate the flat mirrors until a null deviation between the light reflected from the object point and the reference line is obtained. Means are provided to measure the angular rotation of the mirrors necessary to produce the null deviation, which angular rotation is a measure of the spatial position of the object point with respect to the reference line.

## METHOD OF DETECTING INHOMOGENEITIES IN CERAMICS

Patent No. : 3,592,050

Issued : 07/13/71

Inventor(s) : A. W. Nutt, Jr. and J. H. Handwerk

Inhomogeneities are detected in a ceramic solid solution by measuring the internal friction in the solid solution and comparing it with a standard. This is done by vibrating a sample thereof at resonant frequency, terminating the vibration, measuring the rate of amplitude decay and comparing this with a standard.

## AUTOMATIC PHOTOELASTIMETER

Patent No. : 3,672,772

Issued : 06/27/72

Inventor(s) : W. L. Primak

This patent relates to a photoelastimeter which includes a rotating birefringent disk positioned to modulate the ellipticity of the polarized light beam. The detected light beam develops an AC signal which is used to drive a servo system. The servo system adjusts the compensator to cancel the ellipticity caused by the birefringence of the sample being examined. A second rotating birefringent disk may also be used to produce additional modulation to improve the action of the servo system by sweeping the dead space of the servo system.

## METHOD AND APPARATUS FOR DETERMINING HYDROGEN CONCENTRATION IN LIQUID SODIUM UTILIZING AN ION PUMP TO IONIZE THE HYDROGEN

Patent No. : 3,683,272

Issued : 08/08/72

Inventor(s) : D. R. Vissers, J. T. Holmes, P. A. Nelson,  
and L. G. Bartholme

This patent relates to a device and method for accurately and rapidly measuring the hydrogen concentration in liquid sodium. A tubular, thin-wall nickel probe which has been annealed at a temperature of 600°C to 900°C for 10 to 60 hours and has its outer surface exposed to liquid sodium is connected to an ion pump. A voltage is applied to said ion pump and maintained at a sufficiently precise and constant level so as to result in the current in said ion pump being constant to within  $\pm 0.1\%$  for any particular concentration of hydrogen in said ion pump. A vacuum of  $10^{-6}$  to  $10^{-8}$  Torr is created within said nickel probe by the ion pump, thereby causing hydrogen atoms in said liquid sodium to diffuse through the wall of the nickel probe and into the interior thereof and be drawn into said ion pump wherein the hydrogen atoms are ionized. The current generated by the ionization of hydrogen atoms within the ion pump is then accurately measured, this current being linearly related to the number of hydrogen atoms ionized and thereby indicative of the hydrogen concentration in the liquid sodium.

## ALKALI METAL LEAK DETECTOR

Patent No. : 3,721,970

Issued : 03/20/73

Inventor(s) : H. R. Niemoth

This invention relates to an alkali metal leak detector in which a layer of refractory fiber insulation is disposed between two layers of conducting material connected in an electrical circuit to a detecting device. A drop of alkali metal will short out the screens and give a signal on the detecting device.

## HYDROGEN ACTIVITY METER

Patent No. : 3,731,523

Issued : 05/08/73

Inventor(s) : D. R. Vissers, J. T. Holmes, and  
P. A. Nelson

This patent describes an equilibrium diffusion-type device for and method of measuring the hydrogen concentration in liquid sodium. A thin-wall, tubular nickel probe, which has been annealed at a temperature of 600°C to 900°C for 10 to 60 hours and has a large outer surface area of 40 to 160 cm<sup>2</sup>, is placed in contact with liquid sodium and connected to an ion pump and a vacuum gauge. A vacuum of  $10^{-6}$  to  $10^{-8}$  Torr is created within the nickel probe by the ion pump, which thereafter is isolated from the remainder of the device. Hydrogen atoms in the liquid sodium diffuse through the wall of the probe and into the interior thereof until an equilibrium between hydrogen atoms within the probe and hydrogen atoms in the liquid sodium is obtained. This diffusion by hydrogen atoms into the probe results in a pressure change therein, and the pressure change occurring between the time of initial probe evacuation and the time equilibrium of the hydrogen atoms is obtained is measured by the vacuum gauge, this pressure change being indicative of the hydrogen concentration in the liquid sodium.

## A METHOD OF MEASURING ENTRAINED GAS IN A LIQUID USING A CONVERGING-DIVERGING NOZZLE

Patent No. : 3,738,154

Issued : 06/12/73

Inventor(s) : R. E. Henry

This patent relates to a method of detecting the presence and measuring the volumetric concentration of entrained gas in a liquid which employs a choked converging-diverging nozzle. The liquid-gas mixture is accelerated through the nozzle to critical flow conditions and the pressure at the throat of the nozzle is measured. The temperature and pressure of the mixture in the stagnation region are monitored, the throat pressure of the mixture being a function of only the void fraction at any given measured stagnation temperature and pressure.



## MAGNETOMETER FLOWMETER USING PERMANENT MAGNETS AND MAGNETOMETER ELEMENTS ALIGNED WITH THE FLOW

Patent No. : 3,824,456

Issued : 07/16/74

Inventor(s) : D. E. Wiegand

This patent relates to a flowmeter for measuring the flow of conducting fluids, in particular liquid sodium. The flowmeter includes a permanent magnet or electromagnet for setting up a steady-state magnetic field in the fluid. A fluxgate element is positioned so as to detect the magnetic field developed by the movement of the fluid through the steady-state magnetic field. The magnitude of the magnetic field developed by the fluid motion is a measure of the fluid velocity.

## GAS VOID DETECTOR FOR LIQUID METAL

Patent No. : 3,830,095

Issued : 08/20/74

Inventor(s) : R. A. Jaross

This patent relates to the detection of gas voids in a liquid metal which is accomplished by pumping the liquid metal through a flowmeter with an electromagnetic pump. The flowmeter measures the rate of flow of the liquid metal which decreases with the presence of gas voids in the liquid metal. When the flow rate is reduced because of the presence of such gas voids an alarm signal is generated.

## MAXIMUM TEMPERATURE MONITOR

Patent No. : 3,851,527

Issued : 12/03/74

Inventor(s) : G. L. Hofman and G. D. Hudman

This patent relates to a passive temperature monitor having two evacuated chambers interconnected by a restricted passageway. One of the chambers is charged with a measured amount of vaporizable substance which has a relatively low vapor pressure at the charging temperature. On heating the monitor, the vapor pressure of the substance increases, thus increasing the portion of that substance in vapor phase throughout the two chambers. On cooling, the vaporized substance condenses, with a portion being trapped within the originally empty chamber.

## TEMPERATURE MEASUREMENT DEVICE

Patent No. : 3,869,918

Issued : 03/11/75

Inventor(s) : B. G. Oltman, K. F. Eckerman, G. P. Romberg and W. Prepejchal

This patent relates to a thermoluminescent dosimeter (TLD) which is exposed to a known amount of radiation and then exposed to the environment where temperature measurements are to be taken. After a predetermined time period, the TLD material is read in a known manner to determine the amount of radiation energy remaining in the TLD material. The difference between the energy originally stored by irradiation and that remaining after exposure to the temperature of the environment is a measure of the average temperature of the environment during the exposure.

## CALIBRATION BLOCK

Patent No. : 3,908,278

Issued : 09/30/75

Inventor(s) : E. G. Sundahl

A hardened metal block is precisely machined, ground and lapped so as to include a number of stepped surfaces that are accurately dimensioned from a base surface. The base surface is of precision flatness in order to be wrung into adhesive contact with a companion block of precision measurements. A portion of the calibration block is removed to provide access to the companion block as a reference point.

## ----- METHODS AND DEVICES -----

## DEVICE FOR CHARGING OR DISCHARGING

Patent No. : 2,868,706

Issued : 01/13/59

Inventor(s) : S. Untermyer and E. Hutter

This patent relates to a loading and unloading device for loading objects into and unloading them from an apparatus in which fluid under pressure is employed, such as a heterogeneous neutronic reactor wherein the fuel elements are in the form of slugs. This device is comprised essentially of a cylindrical member disposed coaxially with and as an accessible extension of an internal tube member of the apparatus in which the objects or fuel elements, are normally disposed in use. The outermost end of the cylindrical extension is closed by a removable seal plug. The lower end of the cylindrical extension is separated from the internal tube by a disk valve which is operated externally. A source of pressure fluid and a drain line are provided in communication with the interior of the cylindrical extension. To load an object into the internal tube, the disk valve is closed, the seal plug is removed, an object is placed in the cylindrical extension, and the seal plug is replaced. The disk valve is then opened and the pressure of the fluid within the cylindrical extension is increased until it is greater than the pressure within the internal tube and forces the object out of the cylindrical extension into the internal tube. To remove an object from the tube the disk valve is opened and the interior of the cylindrical extension is connected to the drain line whereby the operating pressure within the internal tube forces the object out of the internal tube and up into the cylindrical extension. The disk valve is then closed and the seal plug is removed to permit removal of the object.

## POSITIONING DEVICE

Patent No. : 2,894,647

Issued : 07/14/59

Inventor(s) : W. H. McCorkle

This patent covers a positioner for a control rod for a nuclear reactor. The positioner includes a spur gear and rack for adjusting the control rod slowly and in small amounts as well as a piston and cylinder for moving the control rod rapidly through larger distances. The positioner also has associated with it a worm wheel and gear for rotating it out of engagement with the control rod.

## FUEL HANDLING MECHANISM

Patent No. : 2,924,483

Issued : 02/09/60

Inventor(s) : L. J. Koch and E. Hutter

This patent relates to a remotely operable handling device specifically adapted for the handling of vertically disposed fuel rods in a nuclear reactor. The device consists essentially of an elongated tubular member having a gripping device at the lower end of the pivoted jaw type adapted to grip an enlarged head on the upper end of the workpiece. The device includes a sensing element which engages the enlarged head and is displaced thereby to remotely indicate when the workpiece is in the proper position to be engaged by the jaws.

## MEANS AND METHOD FOR PRODUCING A VACUUM

Patent No. : 2,947,465

Issued : 08/02/60

Inventor(s) : M. A. Otavka

This patent relates to evapor-ion vacuum pumps and particularly to a new method for starting their operation. Ordinarily this type of pump is started by inducing an electric field with the vacuum chamber so that electrons will cause a gettering substance to entrap molecules of reactive gases and through ionization and entrapment rid the chamber of inert gases. However, by placing such an electric field in the chamber at the outset a glow discharge may be initiated which is harmful to the pump. This patent covers the procedure whereby a negative electric field is used during which time only gettering action takes place and subsequently reversing the field after a sufficient reduction of the number of gaseous particles in the chamber whereby both gettering and ionizing takes place.

## LOADING AND UNLOADING DEVICE

Patent No. : 2,949,202

Issued : 08/16/60

Inventor(s) : M. Treshow

This patent covers a device for loading and unloading fuel rods into and from a reactor tank through an access hole therein. The device includes parallel links carrying a gripper, which links enable the gripper to go through the access hole and then to be moved laterally from the axis of the access hole to the various locations of the fuel rods in the reactor tank.

## TWO-SPEED DEVICE

Patent No. : 2,977,814

Issued : 04/04/61

Inventor(s) : G. S. Brunson, Jr.

This patent relates to a two-speed device comprising a two-part stop engageable with a follower. The two-part stop comprises first and second members in threaded engagement with each other. The first member is restrained against rotation but is free to move longitudinally, and the second member is free to move axially and rotatively. Means are provided to impart rotation to the second member. The follower is engageable first with an end of one member and then with the corresponding end of the other member after some relative longitudinal movement of the members with respect to one another due to the rotation of the second member and the holding of the first member against rotation.

## MANIPULATOR FOR SLAVE ROBOT

Patent No. : 2,978,118

(See Nuclear Related Technology)

## GAS SEAL

Patent No. : 2,991,905

Issued : 07/11/61

Inventor(s) : H. Monson and E. Hutter

This patent relates to a seal for a cover closing an opening in the top of a pressure vessel that may house a nuclear reactor. The seal comprises a U-shaped trough formed on the pressure vessel around the opening therein, a mass of metal in the trough, and an edge flange on the cover extending loosely into the trough and dipping into the metal mass. The lower portion of the metal mass is kept melted, and the upper portion, solid. The solid portion of the metal mass prevents pressure surges in the vessel from expelling the liquid portion of the metal mass from the trough; the liquid portion, thus held in place by the solid portion, does not allow gas to go through, and so gas cannot escape through shrinkage holes in the solid portion.

## VEHICLE FOR SLAVE ROBOT

Patent No. : 3,018,980

(See Nuclear Related Technology)

## SODIUM-WATER HEAT EXCHANGER

Patent No. : 3,029,796

Issued : 04/17/62

Inventor(s) : W. R. Simmons and L. J. Koch

This patent relates to a heat exchanger comprising a tank for hot liquid and a plurality of concentric, double tubes for cool liquid extending vertically through the tank. According to the present invention these tubes are bonded throughout most of their length but have an unbonded portion at both ends. The inner tubes extend between headers located above and below the tank and the outer tubes are welded into tube sheets forming the top and bottom of the tank at locations in the unbonded portions of the tubes.

## HYDRAULIC SERVO

Patent No. : 3,031,846

Issued : 05/01/62

Inventor(s) : D. E. Wiegand

This patent covers an hydraulic servo in which a small pressure difference produced at two orifices by an electrically operated flapper arm in a constantly flowing hydraulic loop, is hydraulically amplified by two constant flow pumps, two additional orifices, and three unconnected ball pistons. Two of the pistons are of one size and operate against the additional orifices, and the third piston is of a different size and operates between and against the first two pistons.

## APPARATUS FOR SHEARING TUBULAR JACKETS

Patent No. : 3,052,142

Issued : 09/04/62

Inventor(s) : J. P. Simon

This patent covers a machine for removing the jacket from the core of a used rod-like fuel element by shearing the jacket into a spiral ribbon. Three skewed rolls move the fuel element axially and rotatively, and a tool cooperates with one of the rolls to carry out the shearing action.

## IDENTIFICATION BADGE WITH DETACHABLE CLIP

Patent No. : 3,054,201

Issued : 09/18/62

Inventor(s) : M. T. Burns

This patent covers an identification badge and a detachable clip therefor. The clip has a long slot with a round enlarged end, flat on one side. The badge has a headed member that is circular except for a flat side. The badge is connected to, or disconnected from, the clip by insertion of the headed member through the enlarged end of the slot in the clip. The badge is unlikely to be accidentally disconnected from the clip while being worn on a worker's clothing, because the weight of the badge keeps the headed member away from the enlarged end of the slot in the clip, and the headed member can pass through the enlarged end of the slot only at one relative angular position between badge and clip, namely, that angle at which the flat side of the headed member is coincident with the flat side of the enlarged end of the slot.

## ASSEMBLY OF PARALLEL PLATES

Patent No. : 3,086,935

Issued : 04/23/63

Inventor(s) : E. F. Groh and D. H. Lennox

This patent is concerned with a rigid fuel assembly of parallel plates in which keyways are stamped out along the edges of the plates and a self-retaining key is inserted into aligned keyways. Spacers having similar keyways are included between adjacent plates. The entire assembly is locked into a rigid structure by fastening only the outermost plates to the ends of the keys.

## FASTENER FOR AN ASSEMBLY OF PLATES

Patent No. : 3,101,309

Issued : 08/20/63

Inventor(s) : E. F. Groh

This patent relates to a fastener for a spaced-apart parallel plate fuel assembly. The fastener, attached by screws to a key which passes through the edges of the assembled plate, serves as a retainer for the outermost plate as well as bidirectional spacer for separating the fuel assembly from two neighboring fuel assemblies.

## FRICTION-FREE BALANCE

Patent No. : 3,123,165

(See Measurements and Controls)

## IMMISCIBLE LIQUIDS SEPARATOR

Patent No. : 3,181,700

Issued : 05/04/65

Inventor(s) : J. C. Hesson

This patent relates to an immiscible liquids separator arrangement consisting of a vessel, a heavy liquid outlet line having an opening adjacent the bottom of the vessel, a light liquid outlet line having an opening into the vessel above the opening in the heavy liquid outlet line, the light liquid line rising to a maximum height higher than the heavy liquid outlet line, the light liquid outlet line containing a portion of enlarged diameter adjacent the highest point of the heavy liquid outlet line, and means for increasing the pressure in the vessel.

## ROTARY SHAFT CONSTRUCTION WITH DIAPHRAGM TYPE OF SEAL

Patent No. : 3,208,289

Issued : 09/28/65

Inventor(s) : E. Hutter and P. Elias

This patent covers a construction in which a rotary shaft is formed in separate aligned sections with an oscillating eccentric connection between them, whereby the shaft may be sealed by a diaphragm seal. The eccentric connection includes a shiftable plate engaging the diaphragm seal. The significant thing is that the shiftable plate is held against rotation while being shifted back and forth and so the wear on the diaphragm seal is held to a minimum. The shiftable plate is held against rotation by means of two sets of diametrically opposed bearing members located at opposite sides of the shiftable plate and two sets of diametrically opposed openings loosely receiving the bearing members for rolling contact therewith, the openings being formed in two stationary plates located at opposite sides of the shiftable plate so as to confine the shiftable plate to movement in its own plane.

## METHOD AND APPARATUS FOR VIBRATORY COMPACTION

Patent No. : 3,261,378

Issued : 07/19/66

Inventor(s) : J. E. Ayer and F. E. Soppet

This patent relates to a method of making a uniform close-packed dispersion of masses of different diameters within a container, comprising subjecting masses of a predetermined diameter to axial vibration within the container until a close-packed uniform configuration is attained, and thereafter introducing masses of smaller diameter while holding the configuration last previously attained in position by pressure and subjecting it to combined axial and radial vibration until a uniform, close-packed configuration is attained.

## POWDER COUPLING HAVING PRESSURE ADJUSTABLE MEANS

Patent No. : 3,307,665

Issued : 03/07/67

Inventor(s) : J. E. A. Graae

This patent relates to torque transfer mechanisms of the class referred to as powder couplings and the like.

## PROTECTIVE CONTAINER

Patent No. : 3,333,721

Issued : 08/01/67

Inventor(s) : L. J. Marek

This patent relates to a container that is rectangular in horizontal section and is formed of a first pair of opposed vertical side panels and a second pair of opposed vertical side panels perpendicular to the panels of the first pair and provided with side flanges exteriorly engaging the panels of the first pair, which container is specially characterized by a rectangular cover having four downwardly extending edge flanges, two of which lie inside the side panels of the first pair, and the other two of which lie outside the side panels of the second pair.



## LIFTING AN OBJECT CONTAINED IN A BAG

Patent No. : 3,358,857

Issued : 12/19/67

Inventor(s) : G. J. Vogel, E. L. Carls and W. A. Murphy

This patent shows a system for removing contaminated material from a glove box with two hooks, each having a base member. One base member is internal and one is external to a bag, which is sealed to a port in the glove box, and the two base members are clamped together by means external to the bag. Contaminated material is attached to the hook internal to the bag and raised through the port; then, the bag is sealed and severed between the port and the contaminated material.

## SEAL

Patent No. : 3,419,432

(See Energy Conversion)

## CLOSED FLUID SYSTEM PRESSURIZATION

Patent No. : 3,624,759

Issued : 11/30/71

Inventor(s) : R. D. Carlson

This patent relates to the pressurization of a closed fluid system by using a fluid pump. In nuclear reactor closed fluid systems where the fluid is a liquid metal, electromagnetic pumps can be used. In addition, an electromagnetic pump which develops a high pressure gradient within the pump while maintaining the inlet and outlet pressures substantially equal can be used to separate gases from the fluid.

## READING AND WRITING MACHINE USING RAISED PATTERNS

Patent No. : 3,624,772

(See Biological and Medical Sciences)

## HEAT EXCHANGER USING THERMAL CONVECTION TUBES

Patent No. : 3,633,665

Issued : 01/11/72

Inventor(s) : D. M. France and M. Petrick

This patent relates to a heat exchanger constructed with the hotter fluid in a lower region and the cooler fluid in an upper region. A single wall separates the two regions. Vertically mounted thermal convection tubes extending from the hotter fluid to the cooler fluid through the wall act to transfer heat between the fluids. The thermal convection tubes contain a working fluid and provide for substantially isothermal heat transfer, the latent heat of vaporization of the working fluid being the primary mechanism responsible for the heat transfer.

## MIXER-SETTLER APPARATUS

Patent No. : 3,663,178

Issued : 05/16/72

Inventor(s) : W. E. Miller, J. B. Knighton and G. J. Bernstein

This patent relates to a multi-stage mixer-settler apparatus incorporating a plurality of abutting mixing chamber modules and a plurality of abutting settling chamber modules, each settling chamber module abutting two mixing chamber modules. Each settling chamber module includes an L-shaped baffle dividing the settling chamber into a feed compartment and a settling compartment. Effluent from an impeller in the mixing chamber module and apertures in the abutting walls of the settling chamber and mixing chamber modules permit return of different phases to different mixing chambers.

## PRECISION TRIMMER FOR AN ENCAPSULATED SPECIMEN

Patent No. : 3,799,029

Issued : 03/26/74

Inventor(s) : W. R. Cole, J. W. Harrison, B. S. Kotula, J. S. Martich, and T. N. Tahmisian

This patent relates to a specimen trimmer including a carriage assembly which reciprocates a knife blade along a slanted table surface. The specimen is supported in a holder and precisely advanced by means of a micrometer screw towards the blade through an opening in the table surface. Periodically during the trimming operation, the specimen is precisely rotated with a goniometer to obtain a trapezoidal cross section at the trimmed portion of the specimen.

## METHOD OF SECRETLY MARKING A SURFACE EMPLOYING FISSION PRODUCTS

Patent No. : 3,805,067

(See Selected Nuclear Related Technology)

## GRIP ACCESSORY FOR REMOTE-CONTROL MANIPULATOR TONGS

Patent No. : 3,815,761

Issued : 06/11/74

Inventor(s) : M. F. Adam

This patent relates to a master-slave manipulator including an activator handle and tong assembly interconnected by mechanical transmission elements for imparting the movement of the handle to the tongs. A supplementary power unit is mounted on the tong assembly to provide a controlled tong grip when engaged, but is capable of being disengaged to permit unimpeded operation of the tongs from the activator handle.

## HOLLOW CATHODE SPUTTERING DEVICE

Patent No. : 3,830,721

Issued : 08/20/74

Inventor(s) : D. M. Gruen, D. H. W. Carstens and J. F. Kozlowski

This patent relates to an apparatus for the deposition of thin films of material upon articles by cathodic sputtering. Deposition occurs when a flow of appropriate carrier gas carries material sputtered from the interior of the hollow cathode to the article.



## MULTIPURPOSE SAMPLER DEVICE FOR LIQUID METAL

Patent No. : 3,872,718

Issued : 03/25/74

Inventor(s) : P. A. Nelson, V. M. Kolba and  
J. T. Holmes

This patent relates to a device for collecting samples of a liquid metal which includes a casing, a detachable insert within the upper portion of the casing, removable means for supporting the insert within the casing, heaters surrounding the casing for establishing an isothermal zone in the upper portion thereof and a heating zone in the lower portion thereof, a liquid metal inlet tube for feeding liquid metal to the top of the detachable insert through the isothermal zone and the heating zone, an outlet tube and a helical coil of tubing in the heating zone in heat exchange contact with the entering liquid metal, the coil of tubing being disposed between the insert and the outlet tube for discharging liquid metal from the insert.

## ARCHIVE-CUP INSERT FOR LIQUID-METAL SAMPLING

Patent No. : 3,881,355

Issued : 05/06/75

Inventor(s) : P. A. Nelson, V. M. Kolba, E. C. Filewicz  
and J. T. Holmes

This patent describes an insert for collecting liquid-metal samples within a vertical casing and includes an elongated housing with an upper and a lower overflow seal of annular shape. The lower seal includes a centrally located pedestal on which a sample cup is disposed. Liquid metal enters the annulus of the upper seal and overflows into the cup which fills and overflows into the lower seal. Liquid-metal overflow from the lower seal is discharged from the insert. On cooling, the liquid metal trapped within the seals solidifies to hermetically isolate the metal sample within the cup.

## BEARING MOUNTING FOR TELESCOPING TUBES

Patent No. : 3,887,247

Issued : 06/03/75

Inventor(s) : J. E. A. Graae, A. R. Jamrog, A. S.  
Kelecus, and D. P. Mingesz

This patent relates to an improved mounting for bearings facilitating movement between two adjacent concentric tubes of a telescoping tube system. Within the interior wall of the outer of the two adjacent tubes there is located a socket having a shelf within. A bearing is mounted on a mounting piece which has a shoulder. With the mounting piece inserted into the socket the shoulder lodges against and rests upon the shelf so that the position of the bearing is maintained when force is applied to it by the inner tube of the two adjacent tubes.

## ----- MATERIALS AND FABRICATION -----

## METHOD OF WORKING BERYLLIUM

Patent No. : 2,872,363

Issued : 02/03/59

Inventor(s) : R. E. Macherey

This patent pertains to a process for fabricating beryllium metal. The billet of beryllium metal is sheathed with a jacket of either copper or stainless steel. It may then be worked, by drawing or the like at a temperature of 300° to 400°C.

## APPARATUS FOR HIGH PURITY METAL RECOVERY

Patent No. : 2,873,108

Issued : 02/10/59

Inventor(s) : T. T. Magel

The patent describes an apparatus for preparing high purity metal such as uranium, plutonium and the like from an impure mass of the same metal. The apparatus is arranged so that the impure metal is heated and swept by a stream of hydrogen gas bearing a halogen such as iodine. The volatile metal halide formed is carried on to a hot filament where the metal halide is decomposed and the molten high purity metal is collected in a receiver below.

## VELOCITY INDICATOR FOR EXTRUSION PRESS

Patent No. : 2,881,391

Issued : 04/07/59

Inventor(s) : F. J. Digney, Jr., and F. Bevilacqua

This patent relates to a velocity indicator and more particularly to an indicator for measuring the low speed velocity of an object in one direction where the object returns in the opposite direction at a high speed. The indicator comprises a drum having its axis of rotation transverse to the linear movement of the object and a tape wound upon the drum with its free end extending therefrom and adapted to be connected to the object. A constant torque is applied to the drum in a direction to wind the tape on the drum. The speed of the tape in the unwinding direction is indicated on a tachometer which is coupled through a shaft and clutch means to the drum only when the tape is unwinding.

## METHOD OF JACKETING A FISSIONABLE BODY

Patent No. : 2,924,877

Issued : 02/16/60

Inventor(s) : E. C. Creutz

This patent relates to a method for jacketing fuel elements. More particularly, it describes a method whereby a fissionable body is fit into a steel jacket and a steel rimmed closure disc is inserted into the open end of said jacket. The jacket is then drawn through a die and the rim of the disc is welded to the jacket to form an impervious seal therebetween.

## METHOD AND ALLOY FOR BONDING TO ZIRCONIUM

Patent No. : 2,932,887

Issued : 04/19/60

Inventor(s) : F. D. McCuaig and R. D. Misch

This patent relates to a brazing alloy for bonding zirconium and its alloys to other metals, ceramics, and cermets, consisting of 6-9 w/o Ni, 6-9 w/o Cr, Mo, or W, 0-7.5 w/o Fe and the balance Zr.

## METHOD FOR PURIFYING URANIUM

Patent No. : 2,934,425

Issued : 04/26/60

Inventor(s) : J. B. Knighton and H. M. Feder

This patent relates to a process for purifying a uranium-base nuclear material. The nuclear material is dissolved in zinc or a zinc-magnesium alloy and the concentration of magnesium is increased until uranium precipitates.

## APPARATUS AND METHOD FOR ARC WELDING

Patent No. : 2,936,363

Issued : 05/10/60

Inventor(s) : R. A. Noland and C. C. Stone

This patent relates to an apparatus and method for forming a welding arch which is rotated by a magnetic field very rapidly about an annular electrode so that a weld is produced simultaneously over all points of an annular or closed path. This invention inhibits outgassing from the jacket of a fuel slug which is being welded by adjusting the pressure throughout the welding cycle to establish a balance between the gas pressure within the jacket and that of the atmosphere surrounding the jacket. Furthermore, an improved control of the magnetic field producing rotation of the welding arc is disclosed whereby this rotation is prevented from splashing about the metal being welded as the welding arc makes it molten.

## APPARATUS AND METHOD FOR INJECTION CASTING

Patent No. : 2,952,056

Issued : 09/13/60

Inventor(s) : A. B. Shuck

This patent relates to a single-chamber metal casting apparatus wherein molten metal in a vertically movable container can be brought directly into contact with molds, and then by increasing the gas pressure within the chamber the metal is forced upwardly into the molds.

## METAL RESISTIVITY MEASURING DEVICE

Patent No. : 2,965,840

(See Measurements and Control)

## CORROSION REDUCTION

Patent No. : 2,970,885

Issued : 02/07/61

Inventor(s) : S. Greenberg, R. D. Misch and W. E. Ruther

This patent shows a method for reducing the corrosion of magnesium alloys by superheated water by adding about 0.7 parts per million of sodium fluoride and then maintaining the pH at between 6 and 7 by additions from time to time of HF.

## BONDING ALUMINUM METALS

Patent No. : 2,987,816

Issued : 06/13/61

Inventor(s) : R. A. Noland and D. E. Walker

This patent deals with a process of bonding aluminum to aluminum. Silicon powder is applied to at least one of the two surfaces of the two elements to be bonded; the two elements are assembled and rubbed against each other at room temperature whereby any oxide film is ruptured by the silicon crystals in the interface; thereafter heat and pressure are applied whereby an aluminum-silicon alloy is formed, squeezed out from the interface together with any oxide film and the elements bonded at the oxide free surface.

## CONTROL FOR A ROLLING MILL

Patent No. : 2,988,938

(See Measurements and Controls)

## PROCESS OF RECOVERING ALKALI METALS

Patent No. : 2,996,375

Issued : 08/15/61

Inventor(s) : J. Wolkoff

This patent deals with a process of recovering alkali metal vapor by sorption on activated alumina, activated carbon, dehydrated zeolite, activated magnesia or Fuller's earth preheated above the vaporization temperature of the alkali metal and subsequent desorption by heating the solvent under vacuum.

## FUEL CONTAINER CLOSURE

Patent No. : 3,045,108

Issued : 07/17/62

Inventor(s) : C. C. Stone and R. A. Noland

This patent covers a method of producing a spherical closed end on a small thin-walled tube forming a container for reactor fuel. An end cap inserted in the tube has a long slender external projection extending axially from the tube. A heavy electrical current is applied to the projection, and simultaneously a portion of the tube very near the end cap is chilled. A part of the projection is vaporized, and the balance is melted, along with portions of the end cap and the tube. As a result, the end cap is welded to the tube, and the projection in melting is spread out to form a spherical surface on the end cap.

## REFRACTORY METAL TUBE DRAWING

Patent No. : 3,075,637

Issued : 01/29/63

Inventor(s) : C. H. Bean and F. J. Karasek

This patent covers a lubricant for drawing zirconium and other refractory metals. The lubricant is prepared by adding metallic copper powder to a solution of acrylic resin in chlorinated hydrocarbon solvent.

## COAXIAL TUBE COUPLING

Patent No. : 3,079,179

Issued : 02/26/63

Inventor(s) : H. R. Niemoth

This patent shows a device for quickly coupling coaxial tubes in metal-to-metal fashion, so as to be suitable for use in a nuclear reactor. A threaded collar urges a tapered metal extension on the outer coaxial tube into a tapered seat in the device, and simultaneously exerts pressure through a coaxial helical spring so that a similar extension on the inner tube seats in a similar seat near the other end.

## GAMMA RADIATION DOSAGE - MEASURING GLASSES AND METHOD OF USING

Patent No. : 3,089,957

(See Selected Nuclear Related Technology)

## RADIATION DETECTING WITH SHUTTER GLASS

Patent No. : 3,134,019 (See Selected Nuclear Related Technology)

## METHOD AND APPARATUS FOR SEALING TUBES

Patent No. : 3,135,856 Issued : 06/02/64 Inventor(s) : C. C. Stone

This patent shows a method and apparatus for welding tubes to a sheet as in a heat exchanger. The welding gun is held in a harness which is kept oriented by two ropes leading to a common counterweight. The gun is inserted into a tube in the tube sheet, the welding current is turned on and the entire tube sheet makes a full turn.

## GLASS OF HIGH ULTRAVIOLET TRANSMITTANCE, METHOD AND ARTICLES MANUFACTURED THEREFROM

Patent No. : 3,150,281 Issued : 09/22/64 Inventor(s) : A. M. Bishay

This patent shows a glass in the high ultraviolet transmittance range, having the following molar proportions: 4.5  $B_2O_3$ , 1.0  $Al_2O_3$ , and 1.0  $K_2O$ .

## DRAWING APPARATUS

Patent No. : 3,173,284 Issued : 03/16/65 Inventor(s) : C. H. Bean

This patent covers a drawing apparatus that is only about twice as long as the tube being drawn. This is made possible by using a stationary piston and a movable hydraulic cylinder to pull the tube through the drawing apparatus. Because the cylinder rather than the piston is movable, the tube being drawn may extend along side of the cylinder. This side-by-side arrangement of tube and cylinder keeps the over-all length of the drawing apparatus to about twice the length of the tube.

## PROCESS OF MAKING CRUCIBLES

Patent No. : 3,188,231 Issued : 06/08/65 Inventor(s) : Z. D. Jastrzebski

This patent deals with a crucible material consisting of a fired beryllium oxide - calcium aluminate mixture in a ratio of 85-92 to 8-15 per cent by weight, coated with a fired layer of an alumina-magnesia-beryllia mixture or alumina-magnesia-calcium oxide mixture.

## CLADDING PROCESS

Patent No. : 3,200,491 Issued : 08/17/65 Inventor(s) : D. E. Walker and R. A. Noland

This patent deals with a process of cladding a uranium metal containing core with zirconium, titanium, molybdenum or vanadium metal by framing said core with a strip of cladding metal of the same thickness as the core, sandwiching the framed core including the frame between plates of cladding metal, and simultaneously moving a rolling pressure and an intermittent electrical potential along the entire length, through the entire thickness and over the entire width of the assembly from opposite sides, allowing cooling between pressure and electricity applications to avoid melting of the metals. The thickness of the assembly is reduced by the process and continuous bond is formed between the core, the strip and the plates.

## FLUIDIZATION OF SINTERABLE FINES

Patent No. : 3,273,974 (See Chemistry and Chemical Engineering)

## CAPACITOR DISCHARGE CIRCUIT FOR STARTING AND SUSTAINING A WELDING ARC

Patent No. : 3,376,470 Issued : 04/02/68 Inventor(s) : C. C. Stone, R. H. Olp and G. J. Pokorny

This patent relates to a direct current arc starter for use with a welding current source and includes a high-voltage, low-charge capacitor charged to a voltage sufficient to establish an arc and a low-voltage, high-charge capacitor charged to a voltage sufficient to sustain a stable arc. The capacitors are connected in parallel and a diode isolates the lower voltage capacitor from the high-voltage capacitor. The combined circuit is connected in series with an inductor to the welding electrodes.

## OXYGEN SCAVENGING METHOD

Patent No. : 3,387,969 Issued : 06/11/68 Inventor(s) : S. B. Skladzien

This patent covers a method of removing oxide from alkali metal by flowing the alkali metal along one side of a zirconium-bearing membrane at an elevated temperature and simultaneously flowing a calcium-containing alloy along the other side of the membrane.

## METHOD OF MOLTEN METAL SEPARATION

Patent No. : 3,483,913 Issued : 12/16/69 Inventor(s) : D. E. Grosvenor and W. E. Miller

This patent relates to a method of separating molten metal from various mixtures of molten metal with either molten salt or molten metal oxides or combinations of both by contacting the mixtures with a fibrous refractory material which preferentially absorbs the molten salt and/or molten metal oxides.

## METHOD OF INHIBITING THE CORROSION OF TANTALUM BY LIQUID LITHIUM AT HIGH TEMPERATURES

Patent No. : 3,494,805 Issued : 02/10/70 Inventor(s) : J. Y. N. Wang

This patent relates to a method of inhibiting the corrosion of tantalum by liquid lithium at high temperatures comprising adding 0.15 to 1.5 atom percent silicon to the lithium and contacting the tantalum with the lithium at temperatures above 1000°C.

## METHOD OF IMPROVING THE CORROSION RESISTANCE OF STAINLESS STEEL TO SODIUM

Patent No. : 3,514,344 Issued : 05/26/70 Inventor(s) : F. A. Smith and E. L. Kimont

This patent relates to a method of improving the corrosion resistance of nonstabilized type 304 austenitic stainless steel to sodium at about 1000 to 1200°F comprising exposing the stainless steel to sodium at a temperature of over 1400°F for a period of at least 4000 hours.



## METHOD OF MAKING COMBINATION FUEL RODS

Patent No. : 3,517,431

Issued : 06/30/70

Inventor(s) : J. E. Ayer

This patent relates to a method of making uniform close-packed dispersions in which different materials are arranged in layers within a container. Predetermined amounts of different materials which are of a relatively large diameter are added to the container in succession and compacted by vibration. Then, in the same order, successive amounts of material which are relatively smaller in diameter are added to the container in quantities just sufficient to occupy the spaces or interstices between the larger diameter materials of the same type, while vibrating the container.

## METHOD OF INHIBITING THE CORROSION OF TANTALUM BY LIQUID LITHIUM

Patent No. : 3,547,685

Issued : 12/15/70

Inventor(s) : J. Y. N. Wang and K. G. Figlik

This patent relates to a method of inhibiting the corrosion of tantalum by liquid lithium at high temperatures by adding 0.25 to 1.5 atom percent iridium to the lithium.

## A LIQUID METAL PURIFIER

Patent No. : 3,558,122

Issued : 01/26/71

Inventor(s) : A. Jaross

This patent relates to a device for removing oxides from liquid metals, which consists of a vertically disposed double-walled tube, an outer shell concentric with and surrounding the double-walled tube, a heat exchanger at top of the device, a metal oxide collector at the lower end of the device, and a double-walled thermal barrier movable alongside of the metal oxide collector. The device is mounted in the top of a tank containing the liquid metal with the metal oxide collector immersed in the liquid metal. A heat exchange fluid flows upwardly in the double-walled tube, through the heat exchanger, and downwardly in the annulus between the double-walled tube and the outer shell, thereby cooling the metal oxide collector and is prevented from redissolving in the liquid metal by moving the thermal barrier to cover part of the metal oxide collector.

## METHOD OF CASE HARDENING VANADIUM AND VANADIUM ALLOYS

Patent No. : 3,577,283

Issued : 05/04/71

Inventor(s) : R. M. Mayfield, J. A. Zic, and G. F. Hill

A method of case hardening vanadium and vanadium alloys consisting predominantly of vanadium comprising heating the material briefly at 1100 to 1300°C in an atmosphere of argon saturated with water vapor.

## METHOD OF DETECTING INHOMOGENITIES IN CERAMICS

Patent No. : 3,592,050

(See Measurements and Controls)

## METALLIZING CHAMBER VIEWING SYSTEM

Patent No. : 3,620,604

Issued : 11/16/71

Inventor(s) : T. H. Benham

This patent relates to a metallizing chamber viewing system wherein the chamber cover has a single opening which is sealed by the base plate on which the cover is mounted and an evenly contoured exterior surface which has a transparent area serving as a viewing port. A mirror reflects an image of the object being coated through the viewing port and is positioned so as to shield the viewing port from evaporated metal.

## DRAWBENCH

Patent No. : 3,654,794

Issued : 04/11/72

Inventor(s) : S. B. Brak, C. Steves and R. M. Mayfield

This patent relates to a device and method for drawing tubes and rods wherein the workpiece is fixed within a hydraulic cylinder and the die, acting as a piston, is moved along the workpiece. Means are provided for maintaining the workpiece stationary within the cylinder while the die moves along the length of the cylinder over the workpiece to reduce its diameter.

## SOLID FILTERS

Patent No. : 3,661,267

Issued : 05/09/72

Inventor(s) : F. W. Markley

This patent relates to a rigid open-cell plastic foam body useful, for example, as a filter which is prepared by mixing equal parts of a diglycidal ether of bisphenol A epoxy resin and the reaction product of an excess of a polyfunctional amine and a polyfunctional fatty acid with two parts of water while avoiding the entrapment of air in the mixture to form an emulsion in which water is the continuous phase, casting the emulsion in the desired form and curing the emulsion.

## A METHOD FOR MEASURING THE AMOUNT OF COLD WORKING IN A STAINLESS STEEL SAMPLE

Patent No. : 3,739,261

Issued : 06/12/73

Inventor(s) : C. J. Renken, Jr.

This patent relates to a method for measuring the amount of cold working in a stainless steel sample by magnetizing the stainless steel sample in a predetermined direction and mounting a magnetic-field-sensing apparatus in magnetic coupled relationship with the stainless steel sample. The stainless steel sample is then moved relative to the magnetic-field-sensing apparatus to modulate the magnetic coupling there-between responsive to the relative motion and provide magnetic-field scanning of the sample. The signal sensed by the magnetic-field-sensing apparatus is filtered to pass only the modulation frequency of the magnetic coupling, which filtered sensed magnetic-field signal provides a measure of cold working in the stainless steel sample.

## PROCESS OF PREVENTING NITRIDATION OF STEEL SUBMERGED IN LIQUID SODIUM

Patent No. : 3,745,068

Issued : 07/10/73

Inventor(s) : A. K. Fischer

This patent relates to a process of preventing nitridation of steel submerged in liquid sodium containing nitrogen carriers which contain nitrogen and impurities which form said nitrogen carriers, said impurities including nitrogen, which comprises adding to said sodium an effective amount of calcium or magnesium to react with said carriers and said carrier forming impurities to prevent reactive nitrogen from being carried to said steel submerged in the liquid sodium, thereby preventing nitridation of the steel.



## FLOW CONTROL OF FILLER ALLOY

Patent No. : 3,750,266

Issued : 08/07/73

Inventor(s) : T. Hikido and G. R. Moyer

This patent relates to a method for controlling the flow of filler alloy used in the brazing of metals such as stainless steel. The method consists of applying on the surface of the metal a layer of metal which acts as a barrier to the filler alloy, thereby confining the alloy to the desired area to be brazed and thus preventing its flow over undesired areas of the surface of the metal. The flow control metal may, for example, be applied to the surface by scribing, plating or vapor-deposition depending on the type of flow control metal utilized.

## CERAMIC BRAZING METHOD

Patent No. : 3,839,779

Issued : 10/08/74

Inventor(s) : D. E. Walker

This patent relates to a method for brazing a ceramic body to a metal body wherein the bond between said bodies is resistant to high temperatures. A thin layer of a ceramic oxide powder is interposed between the surfaces of the ceramic and metal bodies which are to be joined. The two bodies with the powder therebetween are then subjected to a nonreducing atmosphere at a temperature of at least 1650°C for a minimum period of 5 minutes. These bodies are then cooled at a rate no greater than about 800°C per hour, whereby an essentially hermetic ceramic oxide bond securely seals the two bodies together.

## METHOD OF PRODUCING A LITHIUM-DEPLETED PATTERNED SURFACE ON A LITHIUM NIOBATE CRYSTAL

Patent No. : 3,867,185

Issued : 02/18/75

Inventor(s) : W. L. Primak

This patent relates to a method of producing a lithium-depleted surface layer on a lithium niobate crystal comprising bombarding the crystal surface with ions, exposing the crystal to an atmosphere containing water vapor whereby lithium hydroxide forms as a decoration on the surface, repeatedly washing the surface with water as the decoration phenomena occur, and heating the crystal to about 320°C, thereby immobilizing the remaining lithium to prevent further lithium migration to the bombarded areas.

## ----- PHYSICS, ACCELERATORS AND FUSION -----

## PARTICLE ACCELERATOR

Patent No. : 2,922,061

Issued : 01/19/60

Inventor(s) : L. C. Teng

This patent relates to particle accelerators; more particularly, it describes a combination of two accelerators, namely a cyclotron and a ring-shaped accelerator which has a portion disposed tangentially to the cyclotron. Means are provided to transfer particles from the cyclotron to the ring accelerator including a magnetic deflector within the cyclotron, a magnetic shield between the ring accelerator and the cyclotron, and a magnetic inflector within the ring accelerator.

## RADIO-FREQUENCY PLASMA CONTAINING DEVICE

Patent No. : 3,022,236

Issued : 02/20/62

Inventor(s) : A. J. Ulrich, J. W. Butler, and A. J. Hatch

This patent relates to a method and means for confining and compressing a dense plasma. The device comprises an evacuated spherical cavity into which is injected a heavy hydrogen isotope gas. Thyratron tubes are operated in time quadrature to excite rotating radio frequency fields within the cavity in the even and odd  $TE_{111}$  modes. The excited radio frequency fields ionize the gas and compress it towards the center of the cavity.

## HIGH CURRENT RADIO FREQUENCY ION SOURCE

Patent No. : 3,084,273

Issued : 04/02/63

Inventor(s) : M. E. Abdelaziz

This patent relates to a high current radio frequency ion source. A cylindrical plasma container has a coil disposed around the exterior surface thereof along the longitudinal axis. Means are provided for the injection of an unionized gas into the container and for applying a radio frequency signal to the coil whereby a radio frequency field is generated within the container parallel to the longitudinal axis thereof to ionize the injected gas. Cathode and anode means are provided for extracting transverse to the radio frequency field from an area midway between the ends of the container along the longitudinal axis thereof the ions created by said radio frequency field.

## METHOD FOR CONFINING A DENSE PLASMA

Patent No. : 3,120,477

Issued : 02/04/64

Inventor(s) : A. J. Hatch

This patent relates to a method of containing and compressing plasma discharges which may produce thermonuclear derived neutrons and ultimately useful power. An RF cavity is evacuated and a low Z gas is introduced therein at a low pressure. Stationary electromagnetic waves are excited within the cavity in the  $TE_{210}$  quadrupole mode. The excited electromagnetic waves ionize the low Z gas, confining and compressing the plasma therefrom at the center of the cavity.

## CRUCIBLE SURFACE IONIZATION SOURCE

Patent No. : 3,229,157

Issued : 01/11/66

Inventor(s) : C. M. Stevens and A. L. Harkness

This patent relates to an improved ionization source having a tungsten crucible with a cavity for sample placement, a first current-heated filament surrounding the cavity for heating the sample to its vaporization temperature, an elongated tube for containing the vaporized sample, and a second current-heated filament for heating the vaporized sample to its ionization temperature prior to emission from the containing tube.

## METHOD OF OPERATING AN ION SOURCE FOR A TIME OF FLIGHT MASS SPECTROMETER

Patent No. : 3,296,434

Issued : 01/03/67

Inventor(s) : M. H. Studier

This patent relates to a method of operating a time of flight mass spectrometer ion source having a backing plate and first and second grids. The method comprises generating positive ions between said backing plate and said first grid and periodically generating a negative potential pulse. Each of the negative potential pulses are applied to the first grid while the integral of each of the negative pulses is applied to the backing plate. A negative potential is continuously applied to the second grid.

## APPARATUS FOR PRODUCING A BEAM OF ACCELERATED LIQUID METAL DROPLETS

Patent No. : 3,341,720

Issued : 09/12/67

Inventor(s) : E. S. Sowa

This patent relates to an apparatus for producing a beam of accelerated liquid metal droplets which includes liquid metal fed to a nozzle at whose exit orifice liquid metal droplets are formed. The liquid metal is maintained at electrical ground. A source of alternating voltage is provided having output terminals in phase opposition and symmetrical with respect to electrical ground. A plurality of accelerating electrodes fixed in increasing spatial relationship are mounted along a line which includes the exit orifice of the nozzle. The first of the electrodes is connected to one output terminal of the voltage source and is located adjacent the exit orifice of the nozzle to induce a charge in the liquid metal droplets as they are formed and accelerate the charged droplets away from the exit orifice of the nozzle toward the first electrode. The remaining electrodes are successively connected to alternate terminals of the voltage source and the spacing between the electrodes is related to the frequency and amplitude of the voltage source and to the charge-to-mass ratio of the liquid metal droplets so as to cause the droplets to experience a unidirectional accelerating force.

## DETERMINATION OF ISOTOPIC CONCENTRATIONS

Patent No. : 3,348,447

Issued : 10/24/67

Inventor(s) : J. A. Goleb

This patent relates to a method and apparatus for determining isotopic concentration of two isotopes of an element by means of absorption spectrometry. This involves a hollow-cathode absorption tube containing a reference isotope sputtered by xenon ions and two hollow-cathode emission tubes, one containing the reference isotope and the other containing the sample to be analyzed.

## APPARATUS FOR DAMPING AXIAL COHERENT BEAM INSTABILITIES IN A SYNCHROTRON PARTICLE ACCELERATOR

Patent No. : 3,378,778

Issued : 04/16/68

Inventor(s) : J. H. Martin, R. A. Winje, R. H. Hilden, and F. E. Mills

This patent describes a control system for damping axial coherent oscillations in bunches of charged particles traveling in a fixed orbit in a synchrotron particle accelerator. The control system accomplishes its function by detecting the amplitude of the oscillation of a bunch when the bunch passes a first location along the orbit, tracking the bunch in its orbit, and applying a damping force, proportional to the magnitude of the detected oscillation, at the exact time when the bunch passes a second location along the orbit. The tracking and timing are accomplished by means of a discretely variable delay line controlled by the instantaneous frequency of the energy source driving the accelerator.

## METHOD FOR GENERATING A BEAM OF IONS WHEREIN THE IONS ARE COMPLETELY POLARIZED

Patent No. : 3,461,294

Issued : 08/12/69

Inventor(s) : D. vonEhrenstein and D. C. Hess

This patent relates to a method for producing a polarized ion beam which comprises collimating the atoms of a material into a beam and passing the beam through a first magnetic field to separate the atoms therein into first and second groups. Atoms contained in the second group are then removed from the beam and the beam is passed through combined direct-current and radio-frequency magnetic fields. The beam is then passed through a second magnetic field to separate the atoms therein into third and fourth groups. Atoms contained in the fourth group are removed from the beam and the beam is ionized to produce a beam wherein the ions are completely polarized.

## RADIATION PLUG FOR A PARTICLE ACCELERATOR BEAM TUBE

Patent No. : 3,473,029

Issued : 10/14/69

Inventor(s) : G. W. Parker

This patent relates to a water-filled shielding plug for use in a particle accelerator beam tube and adapted to be inserted into the beam tube from a branch tube, and includes a metallic bellows closed at both ends and a wire for limiting longitudinal expansion of the bellows.

## UNIVERSAL PLANAR X-RAY RESONATOR

Patent No. : 3,518,427

Issued : 06/30/70

Inventor(s) : R. M. J. Cotterill

This invention relates to a device for selecting and conserving a monochromatic X-ray beam by successive reflections from an even number of Bragg reflectors, pairs of which are parallel. This sets forth a geometrical relationship of reflectors which permits tuning X-rays of various wave lengths for any crystal having corresponding Bragg angles ranging from about 15° to about 60°.

## PLASMA TUNING MEANS WHEREIN THE RESONANT FREQUENCY OF A CAVITY RESONATOR TRACKS THE FREQUENCY OF AN IONIZING CONTROL FREQUENCY

Patent No. : 3,525,953

(See Electronics and Electrical Engineering)

## APPARATUS FOR NONDESTRUCTIVELY MEASURING THE POSITION AND PARTICLE-DENSITY PROFILE OF AN ACCELERATOR BEAM

Patent No. : 3,546,577

Issued : 12/08/70

Inventor(s) : F. Hormstra, Jr. and W. H. DeLuca

This patent relates to an apparatus for nondestructively measuring the position and particle-density profile of an accelerator beam operating in a residual gas of a partial pressure wherein the accelerator beam ionizes the residual gas and includes a pair of electrodes mounted parallel to the plane of the accelerator beam on opposing sides thereof. A voltage source applies a potential between the electrodes to generate an electric field normal to the plane of the accelerator beam wherein the residual gas ions are accelerated toward the electrodes to generate an electric current. The electrodes are mounted to intercept the accelerated residual gas ions to produce a current proportional to the particle density of the beam.

## METHOD FOR PRODUCING POLARIZED ATOMS

Patent No. : 3,569,705

Issued : 03/09/71

Inventor(s) : M. S. Kaminsky

This patent relates to a method for producing a polarized beam of atoms by passing in a partial vacuum a collimated atomic beam through a magnetically saturated monocrystalline material parallel to a lattice channel of said foil. The monocrystalline material effects a charge-transfer reaction with the atomic beam to produce a polarized atomic beam, the nuclei of which are subsequently polarized by hyperfine interaction in a weak external magnetic dipole field.

## BRIGHT LINE EMISSION SOURCE FOR ABSORPTION SPECTROSCOPY

Patent No. : 3,600,091

(See Chemistry and Chemical Engineering)

## TRAVELING WAVE PARTICLE SEPARATOR INCLUDING A RECTANGULAR WAVEGUIDE LINED WITH A DIELECTRIC MATERIAL

Patent No. : 3,609,351

Issued : 09/28/71

Inventor(s) : J. W. Dawson and R. L. Kustom

This patent relates to an apparatus for separating relativistic particles in a beam and includes an RF power source and a dielectric-loaded rectangular waveguide structure receiving the output of the RF source for subjecting the beam of relativistic particles passing through the waveguide to transverse deflecting forces generated by propagating electromagnetic fields in the waveguide to effect separation of desired particles in the beam.

## DEVICE FOR MEASURING THE POSITION, SIZE AND INTENSITY OF HIGH ENERGY PARTICLES

Patent No. : 3,612,858

Issued : 10/12/71

Inventor(s) : T. deParry

This patent relates to a particle beam position monitor which includes first and second pairs of plates mounted normal with respect to the longitudinal axis of the particle beam on opposite sides thereof. The associated plates of each of the first and second pairs are fixedly spatially mounted with respect to each other and each have one edge positioned to lie in a single plane parallel to the longitudinal axis of the particle beam. A pair of voltage sources are connected to produce potentials between the associated plates of the first and second pairs respectively and a pair of electrometers measure secondary electron emission from the pairs of plates in the presence of the particle beam. A bridge circuit differentially combines the measured secondary electron emission to provide a relative measure of the position of the particle beam.

## METHOD FOR PRODUCING A BEAM OF POLARIZED ATOMS

Patent No. : 3,700,899

Issued : 10/24/72

Inventor(s) : M. S. Kaminsky

This patent relates to generating a polarized beam of atoms by forming a plurality of apertures of micron-sized diameter through a magnetically saturated monocrystalline material and passing in a partial vacuum a collimated beam of atoms through said apertures incident to the walls thereof. The monocrystalline material effects a charge-transfer reaction with the atomic beam to produce a polarized beam of atoms, the nuclei of which are subsequently polarized by hyperfine interaction in a weak external magnetic field.

## DETECTION SYSTEM FOR HEAVY AND SUPERHEAVY COSMIC RAY NUCLEI

Patent No. : 3,717,767

Issued : 02/20/73

Inventor(s) : R. Gold and K. G. Porges

This patent relates to a detection system using a pair of Cherenkov detectors of different refractive indices which is used for the observation of heavy and superheavy relativistic cosmic ray nuclei. Hodoscopes are used in conjunction with the Cherenkov detectors to determine the path of the nuclei through the Cherenkov detectors. The velocity and charge of the cosmic ray nuclei are determined from conventional pulse height analysis.

## METHOD FOR EFFECTING NUCLEAR POLARIZATION OF A BEAM OF ATOMS

Patent No. : 3,723,741

Issued : 03/27/73

Inventor(s) : D. V. Ehrenstein

This patent relates to nuclear polarization of a beam of atoms which is passed through a magnetically saturated monocrystalline material to effect a charge-transfer reaction between the material and the atomic beam. The atomic beam is then sequentially passed through a first strong magnetic field region shaped decreasing from maximum field to zero field, a zero magnetic field region, and a second strong magnetic field region opposite in polarity to the first strong magnetic field region and shaped from zero field to maximum field to effect nuclear polarization of said atomic beam.

## DEFORMABLE BEAM TRANSPORT SYSTEM WITH EXTRACTION PORT

Patent No. : 3,723,785

Issued : 03/27/73

Inventor(s) : J. M. Nixon and W. J. Ramler

This patent relates to a beam transport device for a particle beam traversing first and second sections of a beam tube and includes a pair of bellows each having an end mounted to an associated one of the sections of the beam tube. Interposed of the bellows and sealed to associated ends thereof are a particle-beam-extraction window and a rigid hollow member juxtaposed of the extraction window. Motive means are coupled to provide motion to the extraction window and rigid hollow member whereby they may be respectively aligned with the particle beam upon deformation of the bellows.

## METHOD OF MEASURING THE TRITIUM CONCENTRATION IN A HIGH-TEMPERATURE ENVIRONMENT

Patent No. : 3,797,299

Issued : 03/19/74

Inventor(s) : P. A. Nelson and R. Kumar

This patent relates to a method of measuring the concentration of tritium present in a molten metal or high-temperature gas wherein tritium present in the molten metal or high-temperature gas is permitted to diffuse through a metal membrane, the tritium diffusing through the membrane is swept away from the membrane by an inert gas containing hydrogen and the radioactivity of the tritium present in the sweep gas is measured.



## METHOD AND MEANS OF EFFECTING CHARGE EXCHANGE IN PARTICLE BEAMS

Patent No. : 3,806,749

Issued : 04/23/74

Inventor(s) : J. L. Yntema

This patent relates to a method and means by which the usable lifetime of carbon stripping foils used to effect charge exchange in particle beams is extended by depositing a thin electrically conducting layer on the foil, mounting the foil on a holder selected to control thermal expansion, and heating the foil before and during the time it is used for stripping.

## MOVING FOIL STRIPPER FOR A PARTICLE ACCELERATOR

Patent No. : 3,866,132

Issued : 02/11/75

Inventor(s) : A. J. Gorka, Jr.

This patent relates to an apparatus for stripping charged particles. Thin foils for stripping a particle beam are stored on the edge of a disk spinning in the accelerator vacuum. Cutting a foil at one edge releases the foil to project beyond the disk for insertion into the beam at a time determined by controlling the phase of the disk. A wiper removes a spent foil from the disk. The foil release and wiper are operable from a remote location.

## MAGAZINE FOR HANDLING STRIPPING FOILS IN A PARTICLE ACCELERATOR

Patent No. : 3,867,704

Issued : 02/18/75

Inventor(s) : A. J. Gorka, Jr.

This invention relates to the means of charge exchange known as stripping. Thin foils for stripping a particle beam are stored in a magazine that is operable remotely to display an individual foil, release it when it is spent, and repeat this process. The magazine is operable in the high-vacuum, high-radiation environment in the interior of a particle accelerator, and it uses the magnetic field of the accelerator to operate the display and dropping mechanism.

## HIGH SPEED LINAC-BEAM ANALYZER

Patent No. : 3,873,839

Issued : 03/25/75

Inventor(s) : K. W. Johnson

This patent relates to a device for analyzing a charged particle beam developed by an accelerator having an RF driving signal. The particle beam passes through a transparent medium which develops light of intensity proportional to the intensity of the particle beam. A photocathode in response to the light develops a corresponding electron beam. The RF driving signal is coupled via a phase varying network to an X-axis deflection system, and, after a phase shift of 90°, to a Y-axis deflection system. The electron beam is directed through the X-axis and Y-axis deflection system, thereby causing the electron beam to precess about an axis and describe a circular trace in a plane perpendicular to the axis. Means are provided to measure the intensity of the beam along a particular narrow arc of the circular trace as the phase of the RF signal applied to the X and Y deflection systems is varied from 0 to 360°.

## METHOD OF MEASURING A PROFILE OF THE DENSITY OF CHARGED PARTICLES IN A PARTICLE BEAM

Patent No. : 3,911,280

Issued : 10/07/75

Inventor(s) : L. G. Hyman and D. J. Jankowski

A profile of the relative density of charged particles in a beam is obtained by disposing a number of rods parallel to each other in a plane perpendicular to the beam and shadowing the beam. A second number of rods is disposed perpendicular to the first rods in a plane perpendicular to the beam and also shadowing the beam. Irradiation of the rods by the beam of charged particles creates radioactive isotopes in a quantity proportional to the number of charged particles incident upon the rods. Measurement of the radioactivity of each of the rods provides a measure of the quantity of radioactive material generated thereby and, together with the location of the rods, provides information sufficient to identify a profile of the density of charged particles in the beam.

## ----- SELECTED NUCLEAR RELATED TECHNOLOGY -----

## OVERALL OPTICAL VIEWER

Patent No. : 2,875,346

Issued : 02/24/59

Inventor(s) : G. S. Monk

This patent relates to apparatus for viewing through a tube any desired internal portion of a reactor. A convex head mounted with a plurality of negative lenses with their axes substantially intersecting is fixed in the tube nearest the portion to be viewed. The interior of the tube is filled with a liquid transparent to light and opaque to neutrons and gamma rays. The lens may be made from polymerized methyl methacrylate and aqueous zinc chloride is a suitable transparent liquid.

## METHOD AND COATING COMPOSITION FOR PROTECTING AND DECONTAMINATING SURFACES

Patent No. : 2,877,131

Issued : 03/10/59

Inventor(s) : D. C. Overhold and M. D. Peterson

This patent relates to a protective coating useful in the decontamination of surfaces exposed to radioactive substances. This coating is placed on the surface before use and is soluble in water, allowing its easy removal in the event decontamination becomes necessary. Suitable coating compositions may be prepared by mixing a water soluble carbohydrate such as sucrose or dextrin, together with a hygroscopic agent such as calcium chloride or zinc chloride.

## CONTROL DEVICE

Patent No. : 2,904,487

Issued : 09/15/59

Inventor(s) : J. J. Dickson

This patent relates to a bimetallic helix comprising a neutron-flux-responsive strip and a second strip having the same coefficient of thermal expansion, for adjusting the extent to which an inner neutron-absorbing member protrudes from an outer hollow neutron-absorbing member.



## THERMAL COUPLE FOR MEASURING TEMPERATURE IN A REACTOR

Patent No. : 2,914,594

Issued : 11/24/59

Inventor(s) : W. Kanne

This invention pertains to a thermal couple device for measuring the temperature of a flowing fluid in a conduit within which is positioned a metallic rod. A thermal couple junction is secured to the rod centrally thereto and thermal insulating support discs having a diameter greater than the rod are secured to the end portions of the rod and adapted to fit transversely in the conduit.

## MANIPULATOR FOR SLAVE ROBOT

Patent No. : 2,978,118

Issued : 04/04/61

Inventor(s) : R. C. Goertz, J. H. Grimson and F. A. Kohut

This patent covers a remote-control manipulator comprising two stationary master units, two slave units on a movable vehicle, and electrical connections between the master and slave units. The slave units are side by side with a minimum overall width, which is made feasible by an arrangement of transducers producing most movements of each slave unit to one side of the support of said slave unit.

## METHOD OF USING AND MANUFACTURING PLASTIC EQUIVALENT TO ORGANIC MATERIALS

Patent No. : 3,005,794

(See Biological and Medical Sciences)

## VEHICLE FOR SLAVE ROBOT

Patent No. : 3,018,980

Issued : 01/30/62

Inventor(s) : R. C. Goertz and J. F. Lindberg

This patent covers a reeling device for an electrical cable supplying power to the slave side of a remote control manipulator mounted on a movable vehicle. As the vehicle carries the slave side about in a closed room, the device reels the cable in and out to maintain a variable length of the cable between the vehicle and a cable inlet in the wall of the room. The device also handles a fixed length of cable between the slave side and the vehicle, in spite of angular movement of the slave side with respect to the vehicle.

## BIOLOGICAL IRRADIATION FACILITY

Patent No. : 3,031,394

(See Biological and Medical Sciences)

## PRODUCTION OF TRITIUM

Patent No. : 3,079,317

Issued : 02/26/63

Inventor(s) : G. H. Jenks, E. M. Shapiro, N. Elliott and C. V. Cannon

This patent relates to a process for the production of tritium by subjecting comminuted solid lithium fluoride containing the lithium isotope of atomic mass number 6 to neutron radiation in a self-sustaining neutronic reactor. The lithium fluoride is heated to above 450°C in an evacuated vacuum-tight container during radiation. Gaseous radiation products are withdrawn and passed through a palladium barrier to recover tritium.

## GAMMA RADIATION DOSAGE-MEASURING GLASSES AND METHOD OF USING

Patent No. : 3,089,957

Issued : 05/14/63

Inventor(s) : A. M. Bishay

This patent shows a dosimeter glass for gamma radiation characterized by a borate base, a substantial amount of bismuth trioxide and a minor amount of either arsenic or antimony trioxides.

## TRITIUM PRODUCTION BY NEUTRON-IRRADIATION OF ALUMINUM-LITHIUM ALLOYS

Patent No. : 3,100,184

Issued : 08/06/63

Inventor(s) : B. M. Abraham

This patent deals with a process of preparing tritium by neutron-bombarding aluminum-lithium alloy and heating the alloy for the release of the tritium formed.

## RADIATION DETECTING WITH SHUTTER GLASS

Patent No. : 3,134,019

Issued : 05/19/64

Inventor(s) : A. M. Bishay

This patent shows a shutter glass for a photocell to sense x-rays, gamma rays and high energy ultraviolet. The latter causes the glass to darken by reason of its content of 0.5 to 5.0 mol percent cerium in cerous form. The darkening reduces the amount of light energy impinging upon the photosensitive element of the photocell, thereby affecting the current in its circuit.

## RADIOGRAPHIC NONDESTRUCTIVE TESTING

Patent No. : 3,359,419

(See Measurements and Controls)

## BORON-LOADED LIQUID SCINTILLATOR

Patent No. : 3,372,127

(See Chemistry and Chemical Engineering)

## METHOD AND MEANS UTILIZING A PULSED ULTRAVIOLET LASER FOR READOUT OF PHOTOLUMINESCENT DOSIMETERS

Patent No. : 3,412,248

Issued : 11/19/68

Inventor(s) : J. Kastner, D. N. Eggenberger, and L. Voyvodic

This patent relates to a dosimetry readout system for photoluminescent material and includes a pulsed ultraviolet laser beam focused upon the photoluminescent material whose output is detected by a first photomultiplier. Using a slotted mirror, the pulsed ultraviolet laser beam is also transmitted to a second photomultiplier whose output is delayed in time and fed to the first photomultiplier to control the operation thereof. The output of the second photomultiplier is delayed in time a period which is equal to the duration greater than the time required for the decay of the component of the visible fluorescence of the photoluminescent dosimeter which is due to the predose or fluorescent background of the dosimeter. The output of the first photomultiplier, which is proportional to the radiation to which the photoluminescent material has been exposed, is then recorded.

## HIGH-VOLTAGE PULSING APPARATUS FOR A SPARK CHAMBER

Patent No. : 3,447,032

Issued : 05/27/69

Inventor(s) : T. A. Romanowski and C. J. Rush

This patent relates to a spark chamber embodying a plurality of spark chamber gaps defined by spatially mounted plate electrodes wherein a capacitor is provided for each spark chamber gap and has one side thereof connected through the center conductor of a coaxial cable to an associated plate electrode. The other plate electrodes are connected to electrical ground through the outer conductors of the coaxial cables. A voltage supply charges the capacitors and a spark chamber trigger switch responsive to spark chamber logic circuitry effects transfer of the capacitor charge to the plate electrodes.

## CALORIMETRIC METHOD OF MEASURING RADIATION BY SOLUTION CONDUCTIVITY CHANGE

Patent No. : 3,489,899

Issued : 01/13/70

Inventor(s) : H. Schmidt

This patent relates to a method for determining the absorbed dosage in a pulse of ionizing radiation by measuring the increase in conductivity of an electrolyte solution due to absorbed radiation.

## PASSIVE MOISTURE METER

Patent No. : 3,602,713

Issued : 08/31/71

Inventor(s) : J. Kastner, B. G. Oltman and Y. Feige

This patent relates to a passive moisture meter which measures the number of thermal neutrons present in a material as a result of natural radiation, such as cosmic rays, to determine the moisture content of the material. The thermal neutron flux in a control region of known moisture content is also measured to determine the magnitude of the high energy flux developed by the natural radiation.

## NEUTRON DOSIMETER INCLUDING A STEP WEDGE FORMED OF AN ALPHA-ATTENUATING MATERIAL

Patent No. : 3,604,931

Issued : 09/14/71

Inventor(s) : J. Kastner and B. G. Oltman

A neutron dosimeter includes a material which emits alpha particles when bombarded with neutrons, a plastic foil in position to intercept these alpha particles and a step wedge of a material, capable of attenuating the alpha particles, disposed between the alpha-emitting material and the plastic foil. The step wedge varies from zero thickness to such a thickness as will attenuate the most energetic alpha particles formed in the dosimeter to particles having an energy such that the particles form tracks in the plastic foil. Following exposure to neutrons the plastic foil is etched to expose the alpha tracks in the plastic. The location of the tracks in the plastic indicates the energy of the neutrons and the total number of tracks in the plastic indicates the intensity of the neutron flux.

## DOSIMETER FORMED OF A RADIATION SENSITIVE THERMOLUMINESCENT MATERIAL AND METHOD OF READING THE SAME

Patent No. : 3,610,926

Issued : 10/05/71

Inventor(s) : J. Kastner and B. G. Oltman

This patent relates to a dosimeter incorporating a crystalline thermoluminescent structure to store radiant energy. The crystalline thermoluminescent material can be a combination of different materials or a single material. The dosimeter is read out by applying energy to the crystal to cause mechanical vibration or crystal lattice vibration at the natural resonant frequency of the crystal. The energy applied may be an alternating current or coherent light energy.

## COUNTER FOR RADIATION MONITORING

Patent No. : 3,732,422

(See Electronics and Electrical Engineering)

## SLOTTED COAXIAL GERMANIUM GAMMA-RAY CAMERA

Patent No. : 3,803,416

Issued : 04/09/74

Inventor(s) : M. G. Strauss

This patent relates to a gamma ray camera wherein an image is obtained of a radiation emitting object using a coaxial germanium semiconductor detector which includes an N-type-semiconductor peripheral region axially separated into a plurality of N-type-semiconductor region segments, and a P-type-semiconductor core region and an intrinsic semiconductor center region between the N-type-peripheral and P-type-core regions.

## METHOD OF SECRETLY MARKING A SURFACE EMPLOYING FISSION PRODUCTS

Patent No. : 3,805,067

Issued : 04/16/74

Inventor(s) : J. Wing

This patent relates to a method of secretly marking or placing intelligence on the surface of an article in such a manner that the markings are undetectable by ordinary methods. This is accomplished by embedding in the surface to be marked a small amount of recoil fission products from a spontaneously fissioning radioactive isotope. These fission products have a very low radioactivity, cause no radiation damage to the article so marked, are detectable only by very sensitive radiation detectors, and the intelligence is discernible only by radioautographic means.

## GRIP ACCESSORY FOR REMOTE-CONTROL MANIPULATOR TONGS

Patent No. : 3,815,761

(See Methods and Devices)

## RADIATION DETECTOR USING ELECTRO-OPTICS

Patent No. : 3,831,028

Issued : 08/20/74

Inventor(s) : I. B. Kerlman, A. Strash, and J. Kastner

This patent relates to a radiation detector consisting of a cell containing a polar liquid positioned between two crossed polarizers. The light beam is directed through the cell to a detector and the polarizers are arranged for extinction of the light. Local birefringence developed by the ionizing radiation permits light to be transmitted to the light detector.

## TEMPERATURE MEASUREMENT DEVICE

Patent No. : 3,869,918

(See Measurements and Controls)

## DETERMINATION OF PARAMETERS OF A NUCLEAR REACTOR THROUGH NOISE MEASUREMENTS

Patent No. : 3,894,912

Issued : 07/15/75

Inventor(s) : C. E. Cohn

This patent relates to a method of measuring parameters of a nuclear reactor by noise measurements. Noise signals are developed by the detectors placed in the reactor core. The polarity coincidence between the noise signals is used to develop quantities from which various parameters of the reactor can be calculated.

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# PATENT TITLES ONLY FOR ALL NUCLEAR FISSION RELATED TECHNOLOGY

## METHOD FOR REMOVING CONTAMINATION FROM PRECIPITATES

Patent No. : 2,867,500      Issued : 01/06/59      Inventor(s) : G. W. Stahl

## PROCESS FOR THE RECOVERY OF PLUTONIUM

Patent No. : 2,868,619      Issued : 01/13/59      Inventor(s) : D. M. Ritter

## DEVICE FOR CHARGING OR DISCHARGING

Patent No. : 2,868,706      Issued : 01/13/59      Inventor(s) : S. Untermeyer and E. Hutter

## NEUTRONIC REACTORS

Patent No. : 2,868,708      Issued : 01/13/59      Inventor(s) : H. C. Vernon

## PLUTONIUM-CUPFERRON COMPLEX AND METHOD OF REMOVING PLUTONIUM FROM SOLUTION

Patent No. : 2,868,817      Issued : 01/13/59      Inventor(s) : H. A. Potratz

## NEUTRON SOURCE

Patent No. : 2,868,990      Issued : 01/13/59      Inventor(s) : W. A. Reardon, D. H. Lennox, and R. G. Nobles

## RECOVERY OF PLUTONIUM VALUES BY FLUORINATION AND FRACTIONATION

Patent No. : 2,869,982      Issued : 01/20/59      Inventor(s) : H. S. Brown and D. S. Webster

## SEPARATION OF METAL SALTS BY ADSORPTION

Patent No. : 2,869,983      Issued : 01/20/59      Inventor(s) : D. M. Gruen

## NUCLEAR REACTOR UNLOADING APPARATUS

Patent No. : 2,870,075      Issued : 01/20/59      Inventor(s) : M. C. Leverett and J. P. Howe

## METHOD AND APPARATUS FOR IMPROVING PERFORMANCE OF A FAST REACTOR

Patent No. : 2,870,076      Issued : 01/20/59      Inventor(s) : L. J. Koch

## NUCLEAR REACTOR COMPONENT CLADDING MATERIAL

Patent No. : 2,871,176      Issued : 01/27/59      Inventor(s) : J. E. Draley and W. E. Ruther

## METHOD OF JACKETING FISSIONABLE MATERIALS

Patent No. : 2,871,555      Issued : 02/03/59      Inventor(s) : L. M. Foster

## SOLVENT EXTRACTION OF URANIUM VALUES

Patent No. : 2,872,285      Issued : 02/03/59      Inventor(s) : H. M. Feder, M. Ader, and L. E. Ross

## BISMUTH PHOSPHATE CARRIER PROCESS FOR PLUTONIUM RECOVERY

Patent No. : 2,872,286      Issued : 02/03/59      Inventor(s) : T. G. Finzel

## METHOD OF SEPARATING TETRAVALENT PLUTONIUM VALUES FROM CERIUM SUB-GROUP RARE EARTH VALUES

Patent No. : 2,872,287      Issued : 02/03/59      Inventor(s) : R. B. Duffield and R. W. Stoughton

## THORIUM-CARBON ALLOYS

Patent No. : 2,872,307      Issued : 02/03/59      Inventor(s) : H. A. Wilhelm and R. E. Rundle

## APPARATUS FOR HIGH PURITY METAL RECOVERY

Patent No. : 2,873,108      Issued : 02/10/59      Inventor(s) : T. T. Magel

## RECOVERY OF PLUTONIUM FROM CERIUM TRIFLUORIDE BY FLUORINATION

Patent No. : 2,873,168      Issued : 02/10/59      Inventor(s) : H. S. Brown and E. G. Bohlmann

## BASIC PEROXIDE PRECIPITATION METHOD OF SEPARATING PLUTONIUM FROM CONTAMINANTS

Patent No. : 2,873,169      Issued : 02/10/59      Inventor(s) : G. T. Seaborg and I. Perlman

## THERMAL DECOMPOSITION OF URANIUM COMPOUNDS

Patent No. : 2,873,184      Issued : 02/10/59      Inventor(s) : T. T. Magel and L. Brewer

## DEPOSITION OF METAL ON NONMETAL FILAMENT

Patent No. : 2,873,185      Issued : 02/10/59      Inventor(s) : T. T. Magel

## THORIUM-SILICON-BERYLLIUM ALLOYS

Patent No. : 2,873,186      Issued : 02/10/59      Inventor(s) : F. G. Foote

NEUTRONIC REACTOR SYSTEM		
Patent No. : 2,873,242	Issued : 02/10/59	Inventor(s) : M. Treshow
MEANS FOR SHIELDING AND COOLING REACTORS		
Patent No. : 2,873,243	Issued : 02/10/59	Inventor(s) : E. P. Wigner, L. A. Chlinger, G. J. Young, and A. M. Weinberg
METHOD OF TESTING HERMETIC CONTAINERS		
Patent No. : 2,873,603	Issued : 02/17/59	Inventor(s) : L. B. Borst
CANNED SLUG		
Patent No. : 2,873,853	Issued : 02/17/59	Inventor(s) : M. Burton
DEVICE FOR TREATING MATERIALS		
Patent No. : 2,874,107	Issued : 02/17/59	Inventor(s) : L. A. Ohlinger, F. Seitz, and G. J. Young
TEST-HOLE CONSTRUCTION FOR A NEUTRONIC REACTOR		
Patent No. : 2,874,108	Issued : 02/17/59	Inventor(s) : L. A. Ohlinger, F. Seitz, and G. J. Young
MEANS FOR TERMINATING NUCLEAR REACTIONS		
Patent No. : 2,874,109	Issued : 02/17/59	Inventor(s) : C. M. Cooper
MEASURING APPARATUS		
Patent No. : 2,874,306	Issued : 02/17/59	Inventor(s) : T. P. Kohman and B. W. Weissbourd
REACTOR SHIELD		
Patent No. : 2,874,307	Issued : 02/17/59	Inventor(s) : E. P. Wigner, L. E. Ohlinger, G. J. Young, and A. M. Weinberg
METHOD AND APPARATUS FOR FABRICATING TUBULAR UNITS		
Patent No. : 2,874,459	Issued : 02/24/59	Inventor(s) : G. W. Haldeman
METHOD OF FORMING PLUTONIUM-BEARING CARRIER PRECIPITATES AND WASHING SAME		
Patent No. : 2,875,022	Issued : 02/24/59	Inventor(s) : B. F. Faris
SEPARATION OF BARIUM VALUES FROM URANYL NITRATE SOLUTIONS		
Patent No. : 2,875,024	Issued : 02/24/59	Inventor(s) : Edward R. Tompkins
METHOD AND APPARATUS FOR HANDLING RADIOACTIVE PRODUCTS		
Patent No. : 2,875,345	Issued : 02/24/59	Inventor(s) : D. Nicoll
OVERALL OPTICAL VIEWER		
Patent No. : 2,875,346	Issued : 02/24/59	Inventor(s) : George S. Monk
PROCESS USING BISMUTH PHOSPHATE AS A CARRIER PRECIPITATE FOR FISSION PRODUCTS AND PLUTONIUM VALUES		
Patent No. : 2,877,090	Issued : 03/10/59	Inventor(s) : T. G. Finzel
COORDINATION COMPOUND-SOLVENT EXTRACTION PROCESS FOR URANIUM RECOVERY		
Patent No. : 2,877,092	Issued : 03/10/59	Inventor(s) : W. H. Reas
ADSORPTION METHOD FOR SEPARATING METAL CATIONS		
Patent No. : 2,877,093	Issued : 03/10/59	Inventor(s) : E. R. Tompkins and G. W. Parker
ADSORPTION METHOD FOR SEPARATING METAL CATIONS		
Patent No. : 2,877,094	Issued : 03/10/59	Inventor(s) : J. X. Khym
METHOD AND COATING COMPOSITION FOR PROTECTING AND DECONTAMINATING SURFACES		
Patent No. : 2,877,131	Issued : 03/10/59	Inventor(s) : D. C. Overhold and M. D. Peterson
CONTROL FOR NEUTRONIC REACTOR		
Patent No. : 2,880,155	Issued : 03/31/59	Inventor(s) : H. V. Lichtenberger and R. A. Cameron
CUTTING AND WEDGING JACKET REMOVER		
Patent No. : 2,880,636	Issued : 04/07/59	Inventor(s) : Melvin Freedman and S. Raynor

## METHOD OF ELECTROPLATING ON URANIUM

Patent No. : 2,884,364

Issued : 04/28/59

Inventor(s) : E. W. Rebol and R. F. Wehrmann

## GASEOUS SCINTILLATION COUNTER

Patent No. : 2,884,529

Issued : 04/28/59

Inventor(s) : C. Egger and C. M. Huddleston

## RECOVERY OF PLUTONIUM AND NEPTUNIUM FROM AQUEOUS SOLUTIONS

Patent No. : 2,886,406

Issued : 05/12/59

Inventor(s) : G. T. Seaborg, R. C. Thompson, and  
F. W. AlbaughTREATMENT OF PLUTONIUM SOLUTION WITH NO OR NO<sub>2</sub> PRIOR TO REMOVAL OF TETRAVALENT PLUTONIUM FROM SAID SOLUTION BY CARRIER PRECIPITATION

Patent No. : 2,886,407

Issued : 05/12/59

Inventor(s) : G. E. Moore

## ENHANCING PRECIPITATIONS BY APPLYING SOLUBLE COMPLEX FLUORINE-CONTAINING REAGENTS

Patent No. : 2,886,408

Issued : 05/12/59

Inventor(s) : G. W. Stahl

## METHOD OF PREPARING PROTACTINIUM VALUES

Patent No. : 2,887,355

Issued : 05/19/59

Inventor(s) : L. I. Katzin, R. G. Larson, R. G.  
Thompson, and Q. VanWinkle

## APPARATUS FOR TESTING EXPANSION OF MOVABLE MEMBERS

Patent No. : 2,887,876

Issued : 05/26/59

Inventor(s) : M. Frankel and W. B. Shank

## PORTABLE SOURCE OF RADIOACTIVITY

Patent No. : 2,891,168

Issued : 06/16/59

Inventor(s) : R. C. Goertz, K. R. Ferguson, E. W.  
Rylander, and L. M. Safranski

## RECOVERY OF PLUTONIUM VALUES FROM DILUTE SOLUTION BY PARTIAL PRECIPITATION OF CARRIER COMPOUNDS

Patent No. : 2,891,841

Issued : 06/23/59

Inventor(s) : D. M. Ritter

## SEPARATION OF URANIUM FROM OTHER METALS

Patent No. : 2,893,822

Issued : 07/07/59

Inventor(s) : H. H. Hyman

## SEPARATION OF URANIUM FROM THORIUM

Patent No. : 2,893,823

Issued : 07/07/59

Inventor(s) : N. N. Hellman

## URANIUM RECOVERY PROCESS

Patent No. : 2,893,824

Issued : 07/07/59

Inventor(s) : H. H. Hyman and J. L. Dreher

## SEPARATION OF PROTACTINIUM FROM CONTAMINANTS

Patent No. : 2,893,825

Issued : 07/07/59

Inventor(s) : J. G. Malm and S. Fried

## PLATINUM HEXAFLUORIDE AND METHOD OF FLUORINATING PLUTONIUM CONTAINING MIXTURES THEREWITH

Patent No. : 2,893,826

Issued : 07/07/59

Inventor(s) : J. G. Malm, B. Weinstock, and  
H. H. Claassen

## PROCESS FOR REMOVING ALUMINUM COATINGS

Patent No. : 2,893,863

Issued : 07/07/59

Inventor(s) : J. Flox

## COATING URANIUM FROM CARBONYLS

Patent No. : 2,894,320

Issued : 07/14/59

Inventor(s) : D. H. Gurinsky and S. S. Storrs

## POSITIONING DEVICE

Patent No. : 2,894,647

Issued : 07/14/59

Inventor(s) : W. H. McCorkle

## SEPARATION PROCESS FOR ACTINIDE ELEMENTS AND COMPOUNDS THEREOF

Patent No. : 2,894,805

Issued : 07/14/59

Inventor(s) : L. B. Werner, I. Perlman, and M. Calvin

## RECOVERY OF PROTACTINIUM FROM AQUEOUS SOLUTIONS

Patent No. : 2,894,806

Issued : 07/14/59

Inventor(s) : R. E. Elson

## CATION EXCHANGE METHOD FOR THE RECOVERY OF PROTACTINIUM

Patent No. : 2,894,807

Issued : 07/14/59

Inventor(s) : M. H. Studier and J. C. Sullivan

## COLUMBIC OXIDE ADSORPTION PROCESS FOR SEPARATING URANIUM AND PLUTONIUM IONS

Patent No. : 2,894,810

Issued : 07/14/59

Inventor(s) : R. H. Beaton



URANIUM SEPARATION PROCESS		
Patent No. : 2,894,827	Issued : 07/14/59	Inventor(s) : E. K. Hyde, L. I. Katzin, and M. J. Wolf
METHOD OF ELECTROPOLISHING URANIUM		
Patent No. : 2,894,883	Issued : 07/14/59	Inventor(s) : D. E. Walker and R. A. Noland
JACKETED URANIUM SLUGS AND METHOD		
Patent No. : 2,894,889	Issued : 07/14/59	Inventor(s) : S. H. Paine, Jr.
NEUTRONIC REACTOR CHARGING AND DISCHARGING		
Patent No. : 2,894,892	Issued : 07/14/59	Inventor(s) : W. H. Zinn
SEPARATION PROCESS FOR PROTACTINIUM AND COMPOUNDS THEREOF		
Patent No. : 2,895,791	Issued : 07/21/59	Inventor(s) : A. Van Winkle
ADSORPTION METHOD FOR SEPARATING THORIUM VALUES FROM URANIUM VALUES		
Patent No. : 2,898,185	Issued : 08/04/59	Inventor(s) : G. E. Boyd, E. R. Russell, and J. Schubert
METHOD OF HEAT-TREATING URANIUM-SILICON ALLOYS		
Patent No. : 2,898,252	Issued : 08/04/59	Inventor(s) : S. T. Ziegler
FUEL ROD CLUSTERS		
Patent No. : 2,898,280	Issued : 08/04/59	Inventor(s) : A. B. Schultz
NEUTRONIC REACTOR CONTROL		
Patent No. : 2,898,281	Issued : 08/04/59	Inventor(s) : S. Untermyer and E. Hutter
REFRACTORY DIE FOR EXTRUDING URANIUM		
Patent No. : 2,899,054	Issued : 08/11/59	Inventor(s) : E. C. Creutz
METHOD OF PREPARING METAL FLUORIDES		
Patent No. : 2,899,269	Issued : 08/11/59	Inventor(s) : J. J. Katz and I. Sheft
PRODUCTION OF THORIUM FLUORIDE		
Patent No. : 2,899,270	Issued : 08/11/59	Inventor(s) : W. H. Zachariasen
METHOD OF DISINTEGRATING REFRACTORY BODIES		
Patent No. : 2,900,230	Issued : 08/18/59	Inventor(s) : R. P. Larsen and R. C. Vogel
METHOD OF PREPARING A FUEL ELEMENT FOR A NUCLEAR REACTOR		
Patent No. : 2,900,263	Issued : 08/18/59	Inventor(s) : J. H. Handwerk and R. A. Bach
SHEATHED TUBE AND APPARATUS AND METHOD OF PRODUCTION THEREOF		
Patent No. : 2,900,315	Issued : 08/18/59	Inventor(s) : L. A. Ohlinger
SALICYLATE PROCESS FOR THORIUM SEPARATION FROM RARE EARTHS		
Patent No. : 2,901,496	Issued : 08/25/59	Inventor(s) : G. A. Cowan
SEPARATION OF THORIUM FROM URANIUM		
Patent No. : 2,902,338	Issued : 09/01/59	Inventor(s) : R. W. Bane
ALLOY COMPOSITIONS		
Patent No. : 2,902,361	Issued : 09/01/59	Inventor(s) : R. L. Reed
FUEL ROD ASSEMBLY		
Patent No. : 2,902,422	Issued : 09/01/59	Inventor(s) : E. Hutter
RECOVERY OF URANIUM BY SECONDARY XANTHATE COMPLEXING		
Patent No. : 2,902,503	Issued : 09/01/59	Inventor(s) : O. K. Neville
METHOD OF PREPARING A FUEL ELEMENT		
Patent No. : 2,902,590	Issued : 09/01/59	Inventor(s) : R. A. Noland and C. C. Stone
SEPARATION OF FISSION PRODUCTS FROM PLUTONIUM BY PRECIPITATION		
Patent No. : 2,903,335	Issued : 09/08/59	Inventor(s) : G. T. Seaborg, S. G. Thompson, and N. R. Davidson



## THORIUM-BERYLLIUM ALLOYS AND METHOD OF PRODUCING SAME

Patent No. : 2,903,351

Issued : 09/08/59

Inventor(s) : F. H. Spedding, H. A. Wilhelm, and  
W. H. Keller

## CONTROL DEVICE

Patent No. : 2,904,487

Issued : 09/15/59

Inventor(s) : J. J. Dickson

## INDEXING MECHANISM

Patent No. : 2,905,338

Issued : 09/22/59

Inventor(s) : L. J. Kock

## METHOD OF SEPARATION OF PLUTONIUM FROM CARRIER PRECIPITATES

Patent No. : 2,905,525

Issued : 09/22/59

Inventor(s) : L. R. Dawson

## REDUCTION IN PLUTONIUM RECOVERY PROCESSES

Patent No. : 2,906,597

Issued : 09/29/59

Inventor(s) : D. M. Ritter and R. P. S. Black

## NEPTUNIUM SOLVENT EXTRACTION PROCESS

Patent No. : 2,907,628

Issued : 10/06/59

Inventor(s) : L. R. Dawson and P. R. Fields

## PREPARATION OF URANIUM HEXAFLUORIDE

Patent No. : 2,907,630

Issued : 10/06/59

Inventor(s) : S. Lawroski, A. A. Jonke, and  
R. K. Steunenbergh

## REACTOR COMPONENT

Patent No. : 2,910,177

Issued : 10/27/59

Inventor(s) : E. C. Creutz

METHOD OF PREPARING  $UF_6$ 

Patent No. : 2,910,344

Issued : 10/27/59

Inventor(s) : R. Davidson and S. Fried

## SEPARATION OF POLONIUM, PROTACTINIUM OR MIXTURES THEREOF IN AQUEOUS SOLUTION FROM BISMUTH, LEAD, ZIRCONIUM AND/OR COLUMBIUM VALUES

Patent No. : 2,910,345

Issued : 10/27/59

Inventor(s) : Q. Van Winkle and K. A. Kraus

## SOLVENT FOR EXTRACTING ACTINIDE SALTS

Patent No. : 2,910,442

Issued : 10/27/59

Inventor(s) : L. Kaplan

## DISSOLUTION OF LANTHANUM FLUORIDE PRECIPITATES

Patent No. : 2,912,303

Issued : 11/10/59

Inventor(s) : B. A. Fries

## THERMAL COUPLE FOR MEASURING TEMPERATURE IN A REACTOR

Patent No. : 2,914,594

Issued : 11/24/59

Inventor(s) : W. Kanne

## PLUTONIUM-HYDROGEN REACTION PRODUCT, METHOD OF PREPARING SAME AND PLUTONIUM POWDER THEREFROM

Patent No. : 2,915,362

Issued : 12/01/59

Inventor(s) : S. Fried and H. L. Baumbach

## METHOD OF MAKING FUEL ELEMENTS

Patent No. : 2,915,815

Issued : 12/08/59

Inventor(s) : C. H. Bean and R. E. Macherey

## URANOUS IODATE AS A CARRIER FOR PLUTONIUM

Patent No. : 2,917,358

Issued : 12/15/59

Inventor(s) : D. R. Miller, G. T. Seaborg, and  
S. G. Thompson

## SEPARATION OF FISSION PRODUCT VALUES FROM THE HEXAVALENT PLUTONIUM BY CARRIER PRECIPITATION

Patent No. : 2,917,359

Issued : 12/15/59

Inventor(s) : T. H. Davies

## METHOD OF RECOVERING TRANSURANIC ELEMENTS OF AN ATOMIC NUMBER BELOW 95

Patent No. : 2,917,361

Issued : 12/15/59

Inventor(s) : G. T. Seaborg and R. A. James

## SEPARATION OF PLUTONIUM FROM URANIUM

Patent No. : 2,917,382

Issued : 12/15/59

Inventor(s) : H. M. Feder and R. L. Nuttall

## NUCLEAR REACTOR INCLUDING A PACKAGE SAFETY DEVICE

Patent No. : 2,919,236

Issued : 12/29/59

Inventor(s) : W. H. Zinn

## NEUTRONIC REACTORS

Patent No. : 2,920,025

Issued : 01/05/60

Inventor(s) : J. B. Anderson

PROCESS OF RECOVERING ZIRCONIUM VALUES FROM HAFNIUM VALUES BY SOLVENT EXTRACTION WITH AN ALKYL PHOSPHATE		
Patent No. : 2,923,607	Issued : 02/02/60	Inventor(s) : D. F. Peppard
FUEL HANDLING MECHANISM		
Patent No. : 2,924,483	Issued : 02/09/60	Inventor(s) : L. J. Koch and E. Hutter
SOLVENT EXTRACTION PROCESS FOR PLUTONIUM		
Patent No. : 2,924,506	Issued : 02/09/60	Inventor(s) : H. H. Anderson and L. B. Asprey
METHOD OF JACKETING A FISSIONABLE BODY		
Patent No. : 2,924,877	Issued : 02/16/60	Inventor(s) : E. C. Creutz
CONCENTRATION OF PLUTONIUM USING AN IODATE PRECIPITATE		
Patent No. : 2,926,067	Issued : 02/23/60	Inventor(s) : B. A. Fries
METHOD FOR THE PREPARATION OF PLUTONIUM HALIDES AND OXYHALIDES		
Patent No. : 2,926,068	Issued : 02/23/60	Inventor(s) : N. R. Davidson and J. J. Katz
NEUTRONIC REACTOR WITH ACCESSIBLE THIMBLE AND EMERGENCY COOLING FEATURES		
Patent No. : 2,926,127	Issued : 02/23/60	Inventor(s) : W. H. McCorkle
NEUTRONIC REACTOR CONSTRUCTION AND OPERATION		
Patent No. : 2,928,779	Issued : 03/15/60	Inventor(s) : J. M. West and J. T. Weills
A COOLED NEUTRONIC REACTOR		
Patent No. : 2,928,781	Issued : 03/15/60	Inventor(s) : E. P. Wigner and E. C. Creutz
PROCESS FOR SEPARATING PLUTONIUM BY REPEATED PRECIPITATION WITH AMPHOTERIC HYDROXIDE CARRIERS		
Patent No. : 2,931,701	Issued : 04/05/60	Inventor(s) : B. F. Faris
METATHESIS OF PLUTONIUM CARRIER LANTHANUM FLUORIDE PRECIPITATE WITH AN ALKALI		
Patent No. : 2,931,702	Issued : 04/05/60	Inventor(s) : R. B. Duffield
NEUTRON REACTOR		
Patent No. : 2,931,762	Issued : 04/05/60	Inventor(s) : E. Fermi
METHOD AND ALLOY FOR BONDING TO ZIRCONIUM		
Patent No. : 2,932,887	Issued : 04/19/60	Inventor(s) : F. D. McCuaig and R. D. Misch
CONCENTRATION OF PLUTONIUM USING OXALATE TYPE CARRIER		
Patent No. : 2,933,369	Issued : 04/19/60	Inventor(s) : D. M. Ritter and R. P. S. Black
DISSOLUTION METHOD OF REMOVING BONDING AGENTS		
Patent No. : 2,933,421	Issued : 04/19/60	Inventor(s) : H. H. Hyman
PRECIPITATION METHOD FOR THE SEPARATION OF PLUTONIUM AND RARE EARTHS		
Patent No. : 2,934,402	Issued : 04/26/60	Inventor(s) : S. G. Thompson
RECOVERY OF AMERICIUM		
Patent No. : 2,934,403	Issued : 04/26/60	Inventor(s) : M. Ader and H. H. Hyman
SCAVENGER AND PROCESS OF SCAVENGING		
Patent No. : 2,934,404	Issued : 04/26/60	Inventor(s) : C. M. Olson
METHOD FOR PURIFYING URANIUM		
Patent No. : 2,934,425	Issued : 04/26/60	Inventor(s) : J. B. Knighton and H. M. Feder
STEAM FORMING NEUTRONIC REACTOR AND METHOD OF OPERATING IT		
Patent No. : 2,936,273	Issued : 05/10/60	Inventor(s) : S. Untermyer
SEPARATION OF PLUTONIUM FROM FISSION PRODUCTS BY A COLLOID REMOVAL PROCESS		
Patent No. : 2,937,924	Issued : 05/24/60	Inventor(s) : J. Schubert
SUPERHEATING IN A BOILING WATER REACTOR		
Patent No. : 2,938,845	Issued : 05/31/60	Inventor(s) : M. Treshow
CONCENTRATION PROCESS FOR PLUTONIUM IONS, IN AN OXIDATION STATE NOT GREATER THAN +4 IN AQUEOUS ACID SOLUTION		
Patent No. : 2,940,819	Issued : 06/14/60	Inventor(s) : G. T. Seaborg and S. G. Thompson
SEPARATION OF PLUTONIUM VALUES FROM OTHER METAL VALUES IN AQUEOUS SOLUTIONS BY SELECTIVE COMPLEXING AND ADSORPTION		
Patent No. : 2,942,939	Issued : 06/28/60	Inventor(s) : R. H. Beaton

## COMPLEX FLUORIDES OF PLUTONIUM AND AN ALKALI METAL

Patent No. : 2,947,601      Issued : 08/02/60      Inventor(s) : G. T. Seaborg

## TERNARY ALLOYS OF URANIUM, COLUMBIUM, AND ZIRCONIUM

Patent No. : 2,947,621      Issued : 08/02/60      Inventor(s) : F. G. Foote

## LOADING AND UNLOADING DEVICE

Patent No. : 2,949,202      Issued : 08/16/60      Inventor(s) : M. Treshow

## METHOD OF PROTECTING TANTALUM CRUCIBLES AGAINST REACTION WITH MOLTEN URANIUM

Patent No. : 2,949,390      Issued : 08/16/60      Inventor(s) : H. M. Feder and N. R. Chellew

## METHOD FOR SEPARATION OF PLUTONIUM FROM URANIUM AND FISSION PRODUCTS BY SOLVENT EXTRACTION

Patent No. : 2,950,166      Issued : 08/23/60      Inventor(s) : G. T. Seaborg, W. J. Blaedel, and  
M. T. Walling, Jr.

CONCENTRATION AND DECONTAMINATION OF SOLUTIONS CONTAINING PLUTONIUM VALUES BY BISMUTH PHOSPHATE CARRIER  
PRECIPITATION METHODS

Patent No. : 2,950,168      Issued : 08/23/60      Inventor(s) : G. T. Seaborg and S. G. Thompson

## NUCLEAR CONVERSION APPARATUS

Patent No. : 2,952,601      Issued : 09/13/60      Inventor(s) : G. T. Seaborg

## PROCESS OF ELIMINATING HYDROGEN PEROXIDE SOLUTIONS CONTAINING PLUTONIUM VALUES

Patent No. : 2,954,273      Issued : 09/27/60      Inventor(s) : J. G. Barrick and B. A. Fries

## NEUTRONIC REACTOR

Patent No. : 2,954,335      Issued : 09/27/60      Inventor(s) : E. P. Wigner

## CAVE WINDOW

Patent No. : 2,957,210      Issued : 10/25/60      Inventor(s) : M. Levenson

## POWER BREEDER REACTOR

Patent No. : 2,961,393      Issued : 11/22/60      Inventor(s) : H. O. Monson

## DEFLECTION PRESSURE TESTER

Patent No. : 2,966,794      Issued : 01/03/61      Inventor(s) : C. M. Cooper

## METHOD AND APPARATUS FOR CONTROLLING DIRECT-CYCLE NEUTRONIC REACTORS

Patent No. : 2,967,809      Issued : 01/10/61      Inventor(s) : G. A. Reed

## REACTOR-FLASH BOILER-FLYWHEEL POWER PLANT

Patent No. : 2,968,602      Issued : 01/17/61      Inventor(s) : E. Loeb

## NEUTRONIC REACTOR SYSTEM

Patent No. : 2,969,310      Issued : 01/24/61      Inventor(s) : J. J. Goett

## RADIATOR-TYPE FUEL ELEMENT

Patent No. : 2,969,312      Issued : 01/24/61      Inventor(s) : H. O. Monson

## PROCESS FOR REMOVING NOBLE METALS FROM URANIUM

Patent No. : 2,970,050      Issued : 01/31/61      Inventor(s) : J. B. Knighton

## REACTOR

Patent No. : 2,975,114      Issued : 03/14/61      Inventor(s) : S. K. Allison

## NEUTRONIC REACTOR

Patent No. : 2,975,116      Issued : 03/14/61      Inventor(s) : F. Daniels

## FAST NEUTRON REACTION SYSTEM

Patent No. : 2,975,117      Issued : 03/14/61      Inventor(s) : W. H. Zinn

## STEAM GENERATOR

Patent No. : 2,975,770      Issued : 03/21/61      Inventor(s) : H. O. Monson

## METHOD OF REDUCING AQUEOUS RADIOACTIVE NUCLEAR WASTES TO SOLID FORM

Patent No. : 2,977,194      Issued : 03/28/61      Inventor(s) : J. W. Loeding and A. A. Jonke



MANIPULATOR FOR SLAVE ROBOT		
Patent No. : 2,978,118	Issued : 04/04/61	Inventor(s) : R. C. Goertz, J. H. Grimson, and F. A. Kohut
SOLVENT EXTRACTION PROCESS FOR PROTACTINIUM		
Patent No. : 2,978,294	Issued : 04/04/61	Inventor(s) : E. K. Hyde, L. I. Katzin, and M. J. Wolf
RECOVERY OF PLUTONIUM BY CARRIER PRECIPITATION		
Patent No. : 2,978,295	Issued : 04/04/61	Inventor(s) : R. H. Goeckermann
NEUTRONIC REACTOR		
Patent No. : 2,978,398	Issued : 04/04/61	Inventor(s) : H. E. Metcalf and H. W. Johnson
METHOD FOR RECOVERING PLUTONIUM VALUES FROM SOLUTION USING A BISMUTH HYDROXIDE CARRIER PRECIPITATE		
Patent No. : 2,981,591	Issued : 04/25/61	Inventor(s) : B. F. Faris
METHOD AND APPARATUS FOR CALCINING SALT SOLUTIONS		
Patent No. : 2,981,592	Issued : 04/25/61	Inventor(s) : S. Lawroski, A. A. Jonke, and R. G. Taecker
PRODUCTION OF PLUTONIUM FLUORIDE FROM BISMUTH PHOSPHATE PRECIPITATE CONTAINING PLUTONIUM VALUES		
Patent No. : 2,982,599	Issued : 05/02/61	Inventor(s) : H. S. Brown and E. G. Bohlmann
URANIUM DECONTAMINATION WITH RESPECT TO ZIRCONIUM		
Patent No. : 2,982,600	Issued : 05/02/61	Inventor(s) : S. Vogler and M. Beederman
PREPARATION OF NEPTUNIUM HEXAFLUORIDE		
Patent No. : 2,982,604	Issued : 04/25/61	Inventor(s) : G. T. Seaborg and H. S. Brown
PRETREATING URANIUM FOR METAL PLATING		
Patent No. : 2,982,702	Issued : 05/02/61	Inventor(s) : R. F. Wehrmann
FUEL FOR NEUTRONIC REACTORS AND PROCESS OF MAKING		
Patent No. : 2,982,708	Issued : 05/02/61	Inventor(s) : B. M. Abraham and H. E. Flotow
SYSTEM FOR UNLOADING REACTORS		
Patent No. : 2,982,711	Issued : 05/02/61	Inventor(s) : A. C. Rand, Jr.
HETEROGENEOUS NUCLEAR REACTOR EMPLOYING SMALL UNCLAD BODIES OF FISSIONABLE MATERIAL AS FUEL		
Patent No. : 2,983,658	Issued : 05/09/61	Inventor(s) : H. H. Hyman and J. J. Katz
NEUTRONIC REACTOR BURIAL ASSEMBLY		
Patent No. : 2,983,659	Issued : 05/09/61	Inventor(s) : M. Treshow
NEUTRONIC REACTOR STRUCTURE		
Patent No. : 2,986,508	Issued : 05/30/61	Inventor(s) : H. C. Vernon and A. M. Weinberg
TWISTED RIBBON FUEL ELEMENT		
Patent No. : 2,987,458	Issued : 06/06/61	Inventor(s) : C. R. Breden and A. B. Schultz
METHOD OF FABRICATING TUBULAR UNITS		
Patent No. : 2,988,812	Issued : 06/20/61	Inventor(s) : L. A. Ohlinger
NUCLEAR REACTOR		
Patent No. : 2,989,454	Issued : 06/20/61	Inventor(s) : C. R. Breden and J. R. Dietrich
METHOD OF PREPARING COMPLEXES OF PLUTONIUM WITH DIKETONES		
Patent No. : 2,989,556	Issued : 06/20/61	Inventor(s) : J. S. Dixon, J. J. Katz, and E. F. Orlemann
IMPROVEMENT IN DECONTAMINATION OF AQUEOUS ACIDIC SOLUTIONS CONTAINING PLUTONIUM AND FISSION PRODUCT VALUES BY PROVIDING CEROUS AND/OR MERCURIC IONS THEREIN PRIOR TO A BISMUTH PHOSPHATE CARRIER PRECIPITATION		
Patent No. : 2,990,241	Issued : 06/27/61	Inventor(s) : B. F. Faris and H. K. Strassel
ADSORPTION OF PLUTONIUM AND/OR FISSION PRODUCTS FROM AQUEOUS SOLUTION		
Patent No. : 2,990,243	Issued : 06/27/61	Inventor(s) : R. H. Beaton



## METATHESIS OF BISMUTH PHOSPHATE PLUTONIUM CARRIER PRECIPITATE WITH AN ALKALI

Patent No. : 2,990,245	Issued : 06/27/61	Inventor(s) : I. Perlman, S. G. Thompson, and B. B. Cunningham
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## URANIUM-TITANIUM-NIOBIUM ALLOYS

Patent No. : 2,990,274	Issued : 06/27/61	Inventor(s) : S. Greenberg
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## MEANS FOR CONTROLLING REACTIONS

Patent No. : 2,990,355	Issued : 06/27/61	Inventor(s) : L. W. Nordheim and E. P. Wigner
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## METHOD AND APPARATUS FOR CONTROLLING NEUTRON DENSITY

Patent No. : 2,990,357	Issued : 06/27/61	Inventor(s) : E. P. Wigner, A. M. Weinberg, and G. J. Young
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## PURIFICATION OF PLUTONIUM USING A CERIUM PRECIPITATE AS A CARRIER FOR FISSION PRODUCTS

Patent No. : 2,991,150	Issued : 07/04/61	Inventor(s) : B. F. Faris and C. M. Olson
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## SEPARATING LIQUID MODERATOR FROM A SLURRY TYPE REACTOR

Patent No. : 2,991,236	Issued : 07/04/61	Inventor(s) : H. C. Vernon
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## GAS SEAL

Patent No. : 2,991,905	Issued : 07/11/61	Inventor(s) : H. Monson and E. Hutter
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## NEUTRONIC REACTOR SHIELDING

Patent No. : 2,992,175	Issued : 07/11/61	Inventor(s) : L. B. Borst
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## ION EXCHANGE ADSORPTION PROCESS FOR PLUTONIUM SEPARATION

Patent No. : 2,992,249	Issued : 07/11/61	Inventor(s) : G. E. Boyd, M. D. Taylor, and E. R. Russell
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## PROCESS OF TREATING OR FORMING AN INSOLUBLE PLUTONIUM PRECIPITATE IN THE PRESENCE OF AN ORGANIC SURFACE ACTIVE AGENT

Patent No. : 2,992,888	Issued : 07/18/61	Inventor(s) : J. H. Balthis
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## METHOD FOR SEPARATING PLUTONIUM AND FISSION PRODUCTS EMPLOYING AN OXIDE AS A CARRIER FOR FISSION PRODUCTS

Patent No. : 2,992,889	Issued : 07/18/61	Inventor(s) : T. H. Davies
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## PYROMETALLURGICAL METHOD

Patent No. : 2,992,915	Issued : 07/18/61	Inventor(s) : P. A. Nelson
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## COUPLED FAST-THERMAL POWER BREEDER REACTOR

Patent No. : 2,992,982	Issued : 07/18/61	Inventor(s) : R. Avery
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## FAST NEUTRON REACTOR

Patent No. : 2,993,850	Issued : 07/25/61	Inventor(s) : H. Soodak and E. P. Wigner
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## CHIMNEY FOR BOILING WATER REACTOR

Patent No. : 2,994,657	Issued : 08/01/61	Inventor(s) : M. Petrick
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## PRECIPITATION OF PLUTONOUS PEROXIDES

Patent No. : 2,996,352	Issued : 08/15/61	Inventor(s) : J. G. Barrick and J. P. Manion
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## NUCLEAR REACTOR

Patent No. : 2,999,059	Issued : 09/05/61	Inventor(s) : M. Treshow
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## METHOD OF SEPARATING NEPTUNIUM BY LIQUID - LIQUID EXTRACTION

Patent No. : 3,004,823	Issued : 10/17/61	Inventor(s) : D. F. Peppard and G. W. Mason
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## METHOD AND APPARATUS FOR EFFECTING THERMAL BONDS

Patent No. : 3,005,079	Issued : 10/17/61	Inventor(s) : H. O. Monson and R. A. Jaross
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## METHOD OF SEPARATING NEPTUNIUM FROM PLUTONIUM IN AQUEOUS INORGANIC SOLUTION

Patent No. : 3,005,680	Issued : 10/24/61	Inventor(s) : G. T. Seaborg
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## NEUTRONIC REACTOR STRUCTURE

Patent No. : 3,005,764	Issued : 10/24/61	Inventor(s) : F. Daniels
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DENSITY CONTROL IN A REACTOR		
Patent No. : 3,005,765	Issued : 10/24/61	Inventor(s) : J. Marshall, Jr.
METHOD OF USING AND MANUFACTURING PLASTIC EQUIVALENT TO ORGANIC MATERIALS		
Patent No. : 3,005,794	Issued : 10/24/61	Inventor(s) : F. R. Shonka, J. E. Rose, and G. Failla
SEPARATION OF TRANSURANIC ELEMENTS FROM RARE EARTH COMPOUNDS		
Patent No. : 3,009,767	Issued : 11/21/61	Inventor(s) : T. P. Kohman
NUCLEAR REACTORS		
Patent No. : 3,011,962	Issued : 12/05/61	Inventor(s) : L. J. Koch, R. E. Rice, Jr., A. A. Denst, A. J. Rogers, and M. Novick
SPRING DRIVEN ACTUATING MECHANISM FOR NUCLEAR REACTOR CONTROL		
Patent No. 3,018,240	Issued : 01/23/62	Inventor(s) : F. Bevilacqua, F. F. Uecker, and E. F. Groh
VEHICLE FOR SLAVE ROBOT		
Patent No. : 3,018,980	Issued : 01/30/62	Inventor(s) : R. C. Goertz and J. F. Lindberg
SEPARATION OF CURIUM AND AMERICIUM		
Patent No. : 3,022,134	Issued : 02/20/62	Inventor(s) : P. R. Fields and N. M. Isaac
REPROCESSING URANIUM DIOXIDE FUELS		
Patent No. : 3,023,097	Issued : 02/27/62	Inventor(s) : L. Burris, Jr. and A. Schneider
METAL PHTHALOCYANINES		
Patent No. : 3,027,391	Issued : 03/27/62	Inventor(s) : N. A. Frigerio
SODIUM-WATER HEAT EXCHANGER		
Patent No. : 3,029,796	Issued : 04/17/62	Inventor(s) : W. R. Simmons and L. J. Koch
URANIUM RECOVERY FROM NUCLEAR FUEL		
Patent No. : 3,031,261	Issued : 04/24/62	Inventor(s) : R. C. Vogel and W. A. Rodger
BIOLOGICAL IRRADIATION FACILITY		
Patent No. : 3,031,394	Issued : 04/24/62	Inventor(s) : W. H. McCorkle and H. S. Cern
PRECIPITATION OF PLUTONOUS PEROXIDE		
Patent No. : 3,033,645	Issued : 05/08/62	Inventor(s) : B. F. Faris
SEPARATION OF CALIFORNIUM FROM CURIUM BY SOLVENT EXTRACTION		
Patent No. : 3,034,854	Issued : 05/15/62	Inventor(s) : D. F. Peppard and G. W. Mason
REACTOR HAVING NaK-UO <sub>2</sub> SLURRY HELICALLY POSITIONED IN A GRAPHITE MODERATOR		
Patent No. : 3,034,978	Issued : 05/15/62	Inventor(s) : M. B. Rodin and J. C. Carter
REFLECTOR CONTROL OF A BOILING WATER REACTOR		
Patent No. : 3,035,993	Issued : 05/22/62	Inventor(s) : M. Treshow
JACKETED BODY		
Patent No. : 3,037,924	Issued : 06/05/62	Inventor(s) : E. C. Creutz
METHODS OF PREPARATION OF ELEMENT 95		
Patent No. : 3,044,944	Issued : 07/17/62	Inventor(s) : G. T. Seaborg and R. A. James
FUEL CONTAINER CLOSURE		
Patent No. : 3,045,108	Issued : 07/17/62	Inventor(s) : C. C. Stone and R. A. Noland
PROCESS OF TREATING URANIUM HEXAFLUORIDE AND PLUTONIUM HEXAFLUORIDE MIXTURES WITH SULFUR TETRAFLUORIDE TO SEPARATE SAME		
Patent No. : 3,046,089	Issued : 07/24/62	Inventor(s) : M. J. Steindler
PROCESS FOR DISSOLVING BINARY URANIUM-ZIRCONIUM OR ZIRCONIUM-BASE ALLOY		
Patent No. : 3,049,401	Issued : 08/14/62	Inventor(s) : A. A. Jonke, J. J. Barghuse, and N. M. Levitz

## SOLVENT EXTRACTION PROCESS FOR SEPARATING ACTINIDE AND LANTHANIDE METAL VALUES

Patent No. : 3,049,402

Issued : 08/14/62

Inventor(s) : R. A. Hildebrandt, H. H. Hyman, and  
S. Vogler

## METHOD OF OPERATING A HEAVY WATER MODERATED REACTOR

Patent No. : 3,049,480

Issued : 08/14/62

Inventor(s) : H. C. Vernon

## DIRECT-CYCLE, BOILING-WATER NUCLEAR REACTOR

Patent No. : 3,049,487

Issued : 08/14/62

Inventor(s) : J. M. Harrer, L. W. Fromm, Jr.,  
and V. M. Kolba

## APPARATUS FOR SHEARING TUBULAR JACKETS

Patent No. : 3,052,142

Issued : 09/04/62

Inventor(s) : J. P. Simon

## CONTROL SYSTEM

Patent No. : 3,061,533

Issued : 10/30/62

Inventor(s) : R. H. Shannon and H. E. Williamson

## SEPARATION OF URANIUM, PLUTONIUM AND FISSION PRODUCTS FROM NEUTRON-BOMBARDED URANIUM

Patent No. : 3,063,830

Issued : 11/13/62

Inventor(s) : A. B. Martin, I. Johnson, L. Burris,  
Jr., I. O. Winsch, and H. M. Feder

## PROTECTED NUCLEAR FUEL ELEMENT

Patent No. : 3,067,116

Issued : 12/04/62

Inventor(s) : J. H. Kittel and J. F. Schumar

## NEUTRONIC REACTOR

Patent No. : 3,069,341

Issued : 12/18/62

Inventor(s) : F. Daniels

## METHOD OF MAKING SPHERICAL ACTINIDE CARBIDE

Patent No. : 3,070,420

Issued : 12/25/62

Inventor(s) : G. D. White and D. C. O'Rourke

## NEUTRONIC REACTOR

Patent No. : 3,070,529

Issued : 12/25/62

Inventor(s) : E. P. Wigner

## NEUTRONIC REACTOR POWER PLANT

Patent No. : 3,070,530

Issued : 12/25/62

Inventor(s) : H. E. Metcalf

## FUEL SUBASSEMBLY CONSTRUCTION FOR RADIAL FLOW IN A NUCLEAR REACTOR

Patent No. : 3,070,537

Issued : 12/25/62

Inventor(s) : M. Treshow

## FUEL ASSAY REACTOR

Patent No. : 3,070,538

Issued : 12/25/62

Inventor(s) : B. I. Spinrad, H. A. Sandmeier, and  
F. H. Martens

## REACTOR FUEL ELEMENTS TESTING CONTAINER

Patent No. : 3,073,767

Issued : 01/15/63

Inventor(s) : G. K. Whitham and R. R. Smith

## METHOD OF OPERATING A NEUTRONIC REACTOR

Patent No. : 3,074,868

Issued : 01/22/63

Inventor(s) : A. Turkevich

## SEPARATION OF EUROPIUM FROM OTHER LANTHANIDE RARE EARTHS BY SOLVENT EXTRACTION

Patent No. : 3,077,378

Issued : 02/12/63

Inventor(s) : D. F. Peppard, E. P. Horwitz, and  
G. W. Mason

## COAXIAL TUBE COUPLING

Patent No. : 3,079,179

Issued : 02/26/63

Inventor(s) : H. R. Niemoth

## PRODUCTION OF TRITIUM

Patent No. : 3,079,317

Issued : 02/26/63

Inventor(s) : G. H. Jenks, E. M. Shapiro, N.  
Elliott, and C. V. Cannon

## ASSEMBLY OF PARALLEL PLATES

Patent No. : 3,086,935

Issued : 04/23/63

Inventor(s) : E. F. Groh and D. H. Lennox

## CONTROL ROD

Patent No. : 3,087,879

Issued : 04/30/63

Inventor(s) : D. E. Walker and S. Matras

## BOILING WATER REACTOR WITH FEED WATER INJECTION NOZZLES

Patent No. : 3,087,881

Issued : 04/30/63

Inventor(s) : M. Treshow

FUEL ELEMENTS FOR NEUTRONIC REACTORS		
Patent No. : 3,088,891	Issued : 05/07/63	Inventor(s) : F. G. Foote and E. R. Jette
BOILING SLURRY REACTOR AND METHOD OF CONTROL		
Patent No. : 3,088,895	Issued : 05/07/63	Inventor(s) : M. Petrick and J. F. Marchaterre
DIMENSIONALLY STABLE, CORROSION RESISTANT NUCLEAR FUEL		
Patent No. : 3,089,768	Issued : 05/14/63	Inventor(s) : J. H. Kittel
NUCLEAR POWER PLANT		
Patent No. : 3,089,840	Issued : 05/14/63	Inventor(s) : J. C. Carter, R. H. Armstrong, and M. J. Janicke
GAMMA RADIATION DOSAGE-MEASURING GLASSES AND METHOD OF USING		
Patent No. : 3,089,957	Issued : 05/14/63	Inventor(s) : A. M. Bishay
FLOW SYSTEM FOR REACTOR		
Patent No. : 3,093,562	Issued : 06/11/63	Inventor(s) : W. H. Zinn
FOIL ELEMENT FOR NUCLEAR REACTOR		
Patent No. : 3,098,025	Issued : 07/16/63	Inventor(s) : R. A. Noland, D. E. Walker, and B. I. Spinrad
FLUORINATION OF OXIDIC NUCLEAR FUEL		
Patent No. : 3,098,709	Issued : 07/23/63	Inventor(s) : W. J. Mecham and J. D. Gabor
APPARATUS FOR CONTROL OF A BOILING REACTOR RESPONSIVE TO STEAM DEMAND		
Patent No. : 3,098,812	Issued : 07/23/63	Inventor(s) : M. Treshow
TRITIUM PRODUCTION BY NEUTRON-IRRADIATION OF ALUMINUM-LITHIUM		
Patent No. : 3,100,184	Issued : 08/06/63	Inventor(s) : B. M. Abraham
FASTENER FOR AN ASSEMBLY OF PLATES		
Patent No. : 3,101,309	Issued : 08/20/63	Inventor(s) : E. F. Groh
NEUTRONIC REACTION SYSTEM		
Patent No. : 3,102,851	Issued : 09/03/63	Inventor(s) : E. P. Wigner
DUCTILE URANIUM FUEL FOR NUCLEAR REACTORS AND METHOD OF MAKING		
Patent No. : 3,109,730	Issued : 11/05/63	Inventor(s) : S. T. Zegler
PRODUCTION OF ACTINIDE METAL		
Patent No. : 3,109,731	Issued : 11/05/63	Inventor(s) : J. B. Knighton
RECOVERY OF ACTINIDES FROM AQUEOUS NITRIC ACID SOLUTIONS		
Patent No. : 3,111,374	Issued : 11/19/63	Inventor(s) : M. Ader
METHOD AND APPARATUS FOR EXAMINING FUEL ELEMENTS FOR LEAKAGE		
Patent No. : 3,116,211	Issued : 12/31/63	Inventor(s) : R. R. Smith, M. W. Echo, and C. B. Doe
PREPARATION OF URANIUM MONOSULFIDE		
Patent No. : 3,119,653	Issued : 01/28/64	Inventor(s) : K. Yoshioka
REACTOR HAVING FUEL ELEMENT COATED WITH BURNABLE POISON		
Patent No. : 3,122,484	Issued : 02/25/64	Inventor(s) : H. P. Iskenderian
COHERENT NUCLEAR REACTOR ELEMENTS		
Patent No. : 3,122,509	Issued : 02/25/64	Inventor(s) : J. H. Handwerk and E. D. Lynch
PROCESS OF PREPARING URANIUM CARBIDE		
Patent No. : 3,123,435	Issued : 03/24/64	Inventor(s) : W. E. Miller, H. L. Stethers, and T. R. Johnson
METHOD AND APPARATUS FOR PRODUCING AND ANALYZING POLARIZED GAMMA RADIATION		
Patent No. : 3,130,315	Issued : 04/21/64	Inventor(s) : M. Hamermesh, S. S. Hanna, and G. J. Perlow
RADIATION DETECTING WITH SHUTTER GLASS		
Patent No. : 3,134,019	Issued : 05/19/64	Inventor(s) : A. M. Bishay



## SEPARATION OF ACTINIDES FROM EACH OTHER

Patent No. : 3,136,600

Issued : 06/09/64

Inventor(s) : S. A. Adar and P. R. Fields

## FAST REACTOR CORE

Patent No. : 3,140,234

Issued : 07/07/64

Inventor(s) : W. B. Loewenstein

## NUCLEAR REACTOR WITH IMPROVED BEAM TUBE

Patent No. : 3,140,236

Issued : 07/07/64

Inventor(s) : C. N. Kelber

## BREEDER REACTOR CORE WITH ALTERNATE ZONES OF DEPLETED AND ENRICHED FUEL

Patent No. : 3,141,827

Issued : 07/21/64

Inventor(s) : H. P. Iskenderian

## FUEL ASSEMBLY FOR LOW POWER REACTORS

Patent No. : 3,145,151

Issued : 08/18/64

Inventor(s) : E. F. Groh

## SEPARATION OF PLUTONIUM, URANIUM, AMERICIUM, AND FISSION PRODUCTS FROM EACH OTHER

Patent No. : 3,147,109

Issued : 09/01/64

Inventor(s) : J. B. Knighton and R. K. Steunenberg

## NUCLEAR REACTOR

Patent No. : 3,149,043

Issued : 09/15/64

Inventor(s) : L. Goldstein, L. Joseph, M. S. Silberstein, and A. A. Weinstein

## FUEL SUBASSEMBLY FOR NUCLEAR REACTOR

Patent No. : 3,150,057

Issued : 09/22/64

Inventor(s) : H. O. Monson and E. Hutter

## AMERICIUM-CURIUM SEPARATION

Patent No. : 3,152,887

Issued : 10/13/64

Inventor(s) : S. Lawroski, J. B. Knighton, and R. K. Steunenberg

## PROCESS FOR PREPARING URANIUM MONOCARBIDE

Patent No. : 3,154,378

Issued : 10/27/64

Inventor(s) : A. Schneider, L. Burris, Jr. and S. Lawroski

## URANIUM RECOVERY FROM ORE CONCENTRATES

Patent No. : 3,154,408

Issued : 10/27/64

Inventor(s) : J. B. Knighton, R. K. Steunenberg, and J. P. LaPlante

## ELEMENT 95 AND METHOD OF PRODUCING SAID ELEMENT

Patent No. : 3,156,523

Issued : 11/10/64

Inventor(s) : G. T. Seaborg

## PREPARATION OF DENSE URANIUM DIOXIDE PARTICLES

Patent No. : 3,160,471

Issued : 12/08/64

Inventor(s) : I. E. Knudsen, A. A. Jonke, and N. M. Levitz

## NUCLEAR REACTOR

Patent No. : 3,160,568

Issued : 12/08/64

Inventor(s) : D. R. MacFarlane

## ELEMENT 96 AND COMPOSITIONS THEREOF

Patent No. : 3,161,462

Issued : 12/15/64

Inventor(s) : G. T. Seaborg

## BOILING-WATER NUCLEAR REACTOR

Patent No. : 3,161,571

Issued : 12/15/64

Inventor(s) : J. M. Harrer, C. F. Bullinger, and V. M. Kolba

## PROCESS FOR PREPARATION OF SULFUR-CONTAINING COMPOUNDS OF PLUTONIUM

Patent No. : 3,162,509

Issued : 12/22/64

Inventor(s) : N. R. Davidson

## REACTOR CONTROL WITH THORIUM CONTROL GRID

Patent No. : 3,162,577

Issued : 12/22/64

Inventor(s) : W. C. Redman

## PREPARATION OF THORIUM METAL FROM THE OXIDE

Patent No. : 3,164,462

Issued : 01/05/65

Inventor(s) : J. B. Knighton, A. V. Hariharan, R. K. Steunenberg and W. H. Hauschildt

## NUCLEAR REACTOR CORE AND FUEL ASSEMBLY

Patent No. : 3,165,448

Issued : 01/12/65

Inventor(s) : W. H. McCorkle and H. S. Cern

## SEPARATION OF PLUTONIUM, URANIUM, AND FISSION PRODUCTS FROM EACH OTHER

Patent No. : 3,169,057

Issued : 02/09/65

Inventor(s) : J. B. Knighton and R. K. Steunenberg

## METHOD OF MAKING PLUTONIUM MONOCARBIDE

Patent No. : 3,170,759

Issued : 02/23/65

Inventor(s) : R. M. Mayfield and W. G. Tope

## PROCESS OF MAKING ACTINIDE SULFIDE AND SIMILAR COMPOUNDS

Patent No. : 3,180,704

Issued : 04/27/65

Inventor(s) : Y. Baskin

## PROCESS OF MAKING RADON FLUORIDE AND OF SEPARATING RARE GASES FROM EACH OTHER

Patent No. : 3,185,548

Issued : 05/25/65

Inventor(s) : P. R. Fields, M. H. Zirin, and  
L. Stein

## FUEL ELEMENT FOR A NUCLEAR REACTOR HAVING STACK OF THIN FUEL WAFERS SUBMERGED IN LIQUID METAL

Patent No. : 3,192,122

Issued : 06/29/65

Inventor(s) : L. R. Kelman and O. L. Kruger

## URANIUM GALLIUM ALLOYS AND METHOD OF PREPARATION

Patent No. : 3,193,380

Issued : 07/06/65

Inventor(s) : W. D. Wilkinson and L. R. Kelman

## URANIUM MONOSULFIDE-MONOCARBIDE NUCLEAR FUEL ELEMENT

Patent No. : 3,194,745

Issued : 07/13/65

Inventor(s) : J. H. Handwerk, G. D. White, and  
P. D. Shalek

## CLADDING PROCESS

Patent No. : 3,200,491

Issued : 08/17/65

Inventor(s) : D. E. Walker and R. A. Noland

## REGENERATION OF NUCLEAR FUEL

Patent No. : 3,218,160

Issued : 11/16/65

Inventor(s) : J. B. Knighton, H. M. Feder, and  
R. K. Steunenberg

## PROCESS OF PREPARING THORIUM METAL FROM THE OXIDE

Patent No. : 3,219,441

Issued : 11/23/65

Inventor(s) : J. B. Knighton and A. V. Hariharan

## PREPARATION OF ACTINIDE MONOCARBIDE

Patent No. : 3,250,590

Issued : 05/10/66

Inventor(s) : E. J. Petkus and A. D. Tevebaugh

## PROCESS OF MAKING A SINTERED, HOMOGENEOUS DISPERSION OF NUCLEAR FUEL AND BURNABLE POISON

Patent No. : 3,263,004

Issued : 07/26/66

Inventor(s) : C. H. Bean

## REMOVAL OF ACTINIDE HALIDES FROM ALUMINA

Patent No. : 3,264,070

Issued : 08/02/66

Inventor(s) : D. Ramaswami, N. M. Levitz, and  
A. A. Jonke

## MULTI-SECTION CONTROL ROD WITH THERMAL EXPANSION JOINT

Patent No. : 3,264,192

Issued : 08/02/66

Inventor(s) : E. A. Wimunc

## URANIUM MONOSULFIDE-URANIUM MONOPHOSPHIDE SOLID SOLUTIONS

Patent No. : 3,264,223

Issued : 08/02/66

Inventor(s) : Y. Baskin and P. D. Shalek

## METHOD FOR CONTROLLING A NUCLEAR REACTOR

Patent No. : 3,267,002

Issued : 08/16/66

Inventor(s) : L. W. Fromm, Jr., and C. N. Kelber

## REMOVAL OF STAINLESS STEEL CLADDINGS FROM NUCLEAR FUEL ELEMENTS

Patent No. : 3,268,303

Issued : 08/23/66

Inventor(s) : D. Ramaswami, N. M. Levitz, and  
A. A. Jonke

## PURIFICATION OF MOLTEN SALTS

Patent No. : 3,271,133

Issued : 09/06/66

Inventor(s) : J. B. Knighton and R. K. Steunenberg

## METHOD AND SYSTEM FOR SUPPLYING THRUST TO A SPACE VEHICLE

Patent No. : 3,274,770

Issued : 09/27/66

Inventor(s) : J. C. Carter and M. B. Rodin

## CALIFORNIUM AND EINSTEINIUM SEPARATION

Patent No. : 3,276,861

Issued : 10/04/66

Inventor(s) : J. B. Knighton and R. K. Steunenberg

## SEAL FOR A CONTROL ROD APPARATUS

Patent No. : 3,280,002

Issued : 10/18/66

Inventor(s) : E. Hutter and T. E. Sullivan

## PREPARATION OF PLUTONIUM MONOSULFIDE AND PLUTONIUM MONOPHOSPHIDE

Patent No. : 3,282,656

Issued : 11/01/66

Inventor(s) : O. L. Kruger, J. B. Moser, and  
B. J. Wrona

## SEPARATION OF URANIUM AND PLUTONIUM VALUES

Patent No. : 3,282,681

Issued : 11/01/66

Inventor(s) : J. B. Knighton and R. K. Steunenberg

## APPARATUS FOR CONTROLLING THE ATMOSPHERE OVER A NUCLEAR REACTOR

Patent No. : 3,282,793

Issued : 11/01/66

Inventor(s) : A. R. Jamrog

## PREPARATION OF PLUTONIUM HEXAFLUORIDE

Patent No. : 3,284,173

Issued : 11/08/66

Inventor(s) : J. Fischer

## SEPARATION OF URANIUM FROM NOBLE AND REFRACTORY METALS

Patent No. : 3,284,190

Issued : 11/08/66

Inventor(s) : J. B. Knighton and R. K. Steunenberg

## PROCESSES OF PRODUCING ENERGY BY NUCLEAR FISSION

Patent No. : 3,284,305

Issued : 11/08/66

Inventor(s) : H. C. Urey, K. Cohen, and F. T. Barr

## NUCLEAR REACTOR FUEL MATERIAL AND A METHOD OF PREPARING THE SAME

Patent No. : 3,287,093

Issued : 11/22/66

Inventor(s) : P. A. Nelson and M. G. Chasanov

## LARGE FAST NUCLEAR REACTOR

Patent No. : 3,287,224

Issued : 11/22/66

Inventor(s) : W. B. Loewenstein

## METHOD OF SEPARATING URANIUM AND PLUTONIUM

Patent No. : 3,294,493

Issued : 12/27/66

Inventor(s) : M. J. Steindler, A. A. Jonke, R. K.  
Steunenberg, M. D. Adams, and R. C.  
Vogel

## FUEL ELEMENT ASSEMBLY

Patent No. : 3,317,398

Issued : 05/02/67

Inventor(s) : E. Hutter

## PROCESS FOR SEPARATING PLUTONIUM FROM URANIUM FROM FISSION PRODUCTS

Patent No. : 3,326,673

Issued : 06/20/67

Inventor(s) : J. B. Knighton, W. Knoch and  
R. K. Steunenberg

## URANIUM MONONITRIDE-SODIUM PASTE NUCLEAR FUEL

Patent No. : 3,338,840

Issued : 08/29/67

Inventor(s) : P. A. Nelson and M. G. Chasanov

## SELECTIVE DECLADDING OF NUCLEAR FUEL ELEMENTS

Patent No. : 3,343,924

Issued : 09/26/67

Inventor(s) : L. J. Anastasia, P. G. Alfredson,  
and M. J. SteindlerOXIDATION-REDUCTION PROCEDURE FOR PARTICLE-SIZE REDUCTION OF  $UO_2$ 

Patent No. : 3,343,926

Issued : 09/26/67

Inventor(s) : I. E. Knudsen and N. M. Levitz

## REACTOR CONTAINMENT VESSEL

Patent No. : 3,349,524

Issued : 10/31/67

Inventor(s) : S. H. Fistedis

## URANIUM CARBIDE-PLUTONIUM PHOSPHIDE AS A REACTOR FUEL

Patent No. : 3,362,914

Issued : 01/09/68

Inventor(s) : O. L. Kruger, J. B. Moser, J. W.  
Thompson, and R. E. Mailhot

## BORON-LOADED LIQUID SCINTILLATOR

Patent No. : 3,372,127

Issued : 03/05/68

Inventor(s) : G. E. Thomas, Jr. and H. E.  
Jackson, Jr.

## NUCLEAR REACTOR ADAPTED FOR USE IN SPACE

Patent No. : 3,378,449

Issued : 04/16/68

Inventor(s) : J. J. Roberts and E. J. Croke

## OXYGEN SCAVENGING METHOD

Patent No. : 3,387,969

Issued : 06/11/68

Inventor(s) : S. B. Skladzien

## METHOD AND MEANS UTILIZING A PULSED ULTRAVIOLET LASER FOR READOUT OF PHOTOLUMINESCENT DOSIMETERS

Patent No. : 3,412,248      Issued : 11/19/68      Inventor(s) : J. Kastner, D. N. Eggenberger, and L. Voyvodic

## PLUTONIUM TETRAFLUORIDE PREPARATION AND SEPARATION BY SORPTION ON SODIUM FLUORIDE

Patent No. : 3,423,190      Issued : 01/21/69      Inventor(s) : M. J. Steindler and A. A. Jonke

## METHOD FOR START-UP OF A NUCLEAR REACTOR UTILIZING A DIGITAL COMPUTER

Patent No. : 3,424,653      Issued : 01/28/69      Inventor(s) : C. E. Cohn

## METHOD AND APPARATUS FOR MAKING PEAS-IN-A-POD NUCLEAR REACTOR ELEMENT

Patent No. : 3,425,115      Issued : 02/04/69      Inventor(s) : J. H. Handwerk and D. E. White

## METHOD OF PREPARING A FUEL MATERIAL FOR USE IN A NUCLEAR REACTOR

Patent No. : 3,431,329      Issued : 03/04/69      Inventor(s) : G. D. White and J. H. Handwerk

## PLUTONIUM SUBLIMATION

Patent No. : 3,436,193      Issued : 04/01/69      Inventor(s) : A. A. Chilenskas

## SEPARATION OF RUTHENIUM AND PLUTONIUM BY A LITHIUM FLUORIDE SORPTION TECHNIQUE

Patent No. : 3,458,291      Issued : 07/29/69      Inventor(s) : J. G. Riha, La Verne E. Trevorrow, and M. J. Steindler

## NEPTUNIUM SEPARATION FROM URANIUM

Patent No. : 3,482,949      Issued : 12/09/69      Inventor(s) : La Verne E. Trevorrow, T. J. Gerding, and M. J. Steindler

## STABILITY IMPROVEMENT FOR NUCLEAR REACTOR AUTOMATIC CONTROL SYSTEM

Patent No. : 3,483,081      Issued : 12/09/69      Inventor(s) : D. W. Sparks and J. H. Tessier

## CALORIMETRIC METHOD OF MEASURING RADIATION BY SOLUTION CONDUCTIVITY CHANGE

Patent No. : 3,489,899      Issued : 01/13/70      Inventor(s) : H. Schmidt

## URANIUM OXIDE FLUORINATION WITH FLUORINE AND FLUORINE INTERHALOGENS

Patent No. : 3,490,881      Issued : 01/20/70      Inventor(s) : J. T. Holmes, D. R. Vissers, J. D. Gabor, I. E. Knudsen

## TELLURIUM HEXAFLUORIDE REMOVAL METHOD

Patent No. : 3,491,513      Issued : 01/27/70      Inventor(s) : D. R. Vissers, M. J. Steindler, and J. T. Holmes

## PRESSURE BALANCED FUEL BUNDLE INLET

Patent No. : 3,501,377      Issued : 03/17/70      Inventor(s) : J. H. Germer

## METHOD OF IMPROVING THE CORROSION RESISTANCE OF STAINLESS STEEL TO SODIUM

Patent No. : 3,514,344      Issued : 05/26/70      Inventor(s) : F. A. Smith and E. L. Kimont

## METHOD OF MAKING COMBINATION FUEL RODS

Patent No. : 3,517,431      Issued : 06/30/70      Inventor(s) : J. E. Ayer

## INSULATED DUCTS FOR NUCLEAR REACTORS

Patent No. : 3,525,669      Issued : 08/25/70      Inventor(s) : J. H. Germer

## NEUTRON FLUX PLOTTING DEVICE

Patent No. : 3,546,455      Issued : 12/08/70      Inventor(s) : K. G. Porges

## A PRECIPITATION METHOD OF RECOVERING AMERICIUM, ELEMENT 95, FROM CONTAMINANTS

Patent No. : 3,551,119      Issued : 12/29/70      Inventor(s) : L. B. Werner

## SELECTIVE ION-EXCHANGE SEPARATION OF ALKALI METALS

Patent No. : 3,554,709      Issued : 01/12/71      Inventor(s) : A. Orlandini and J. Korkisch

## METHOD OF OBTAINING AMERICIUM

Patent No. : 3,554,867      Issued : 01/12/71      Inventor(s) : G. Thompson

## A LIQUID METAL PURIFIER

Patent No. : 3,558,122      Issued : 01/26/71      Inventor(s) : A. Jaross



DISSOLUTION OF STAINLESS STEEL CLAD NUCLEAR FUEL ELEMENTS		
Patent No. : 3,567,648	Issued : 03/02/71	Inventor(s) : W. J. Walsh and R. D. Pierce
RATEMETER WITH AUTOMATIC DEAD-TIME CORRECTION		
Patent No. : 3,573,639	Issued : 04/06/71	Inventor(s) : A. J. Metz and R. H. Howard
METHOD OF PREPARING FUEL PLATES FOR NUCLEAR REACTOR		
Patent No. : 3,576,925	Issued : 04/27/71	Inventor(s) : J. H. Handwerk, J. T. Dusek and G. D. White
REACTOR POWER LEVEL SENSING DEVICE USING CHERENKOV RADIATION		
Patent No. : 3,600,578	Issued : 08/17/71	Inventor(s) : K. G. Porges and R. Gold
PASSIVE MOISTURE METER		
Patent No. : 3,602,713	Issued : 08/31/71	Inventor(s) : J. Kastner, B. G. Oltman, and Y. Feige
NEUTRON DOSIMETER INCLUDING A STEP WEDGE FORMED OF AN ALPHA-ATTENUATING MATERIAL		
Patent No. : 3,604,931	Issued : 09/14/71	Inventor(s) : J. Kastner and B. G. Oltman
PLUTONIUM SEPARATION FROM URANIUM		
Patent No. : 3,607,145	Issued : 09/21/71	Inventor(s) : D. A. Wenz
FUEL ELEMENT VENTING SYSTEM		
Patent No. : 3,607,638	Issued : 09/21/71	Inventor(s) : O. S. Seim
DOSIMETER FORMED OF A RADIATION SENSITIVE THERMOLUMINESCENT MATERIAL AND METHOD OF READING THE SAME		
Patent No. : 3,610,926	Issued : 10/05/71	Inventor(s) : J. Kastner and B. G. Oltman
LARGE VOLUME PLANAR PAIR GERMANIUM (LITHIUM) DETECTOR		
Patent No. : 3,612,869	Issued : 10/12/71	Inventor(s) : J. J. Baum and H. W. Helenberg
PROCESS OF SEPARATING YTRIUM FROM LANTHANIDE RARE EARTHS		
Patent No. : 3,615,171	Issued : 10/26/71	Inventor(s) : G. W. Mason, S. Lewey, A. F. Bollmeier, and D. F. Peppard
CLOSED FLUID SYSTEM PRESSURIZATION		
Patent No. : 3,624,759	Issued : 11/30/71	Inventor(s) : R. D. Carlson
CONTINUOUS DIGITAL RATEMETER		
Patent No. : 3,646,330	Issued : 02/29/72	Inventor(s) : S. J. Rudnick, P. L. Michaud, and K. G. Porges
CYROGENIC SENSING DEVICE USING URANIUM MONOPHOSPHIDE-URANIUM MONOSULPHIDE		
Patent No. : 3,646,813	Issued : 03/07/72	Inventor(s) : M. Kuznietz, G. H. Lander, and Y. Baskin
REPROCESSING A PLUTONIUM DIOXIDE-MOLYBDENUM FUEL		
Patent No. : 3,647,421	Issued : 03/07/72	Inventor(s) : P. A. Nelson and D. A. Wenz
METHOD OF PREPARING OXIDIZED RADON SOLUTIONS		
Patent No. : 3,660,300	Issued : 05/02/72	Inventor(s) : L. Stein
IDENTIFICATION OF FAILED FUEL ELEMENTS		
Patent No. : 3,663,363	Issued : 05/16/72	Inventor(s) : C. E. Crouthamel, L. F. Coleman, G. J. Bernstein, and P. B. Henault
WARM-PRESSING METHOD OF MAKING STACKED FUEL PLATES		
Patent No. : 3,668,285	Issued : 06/06/72	Inventor(s) : C. T. de Freitas and J. W. Handwerk
MIXING AND SETTLING SEPARATION PROCESS FOR URANIUM OR PLUTONIUM		
Patent No. : 3,677,743	Issued : 07/18/72	Inventor(s) : W. J. Walsh and R. D. Pierce
FUEL ASSEMBLY FOR A LIQUID-METAL-COOLED FAST BREEDER REACTOR		
Patent No. : 3,677,893	Issued : 07/18/72	Inventor(s) : T. R. Bump and P. R. Huebotter
METHOD AND APPARATUS FOR DETERMINING HYDROGEN CONCENTRATION IN LIQUID SODIUM UTILIZING AN ION PUMP TO IONIZE THE HYDROGEN		
Patent No. : 3,683,272	Issued : 08/08/72	Inventor(s) : D. R. Vissers, J. T. Holmes, P. A. Nelson, and L. G. Bartholme

A SELECTIVE ION EXCHANGE FOR THE ISOLATION OF CERTAIN ALKALINE EARTHS		
Patent No. : 3,694,369	Issued : 09/26/72	Inventor(s) : K. A. Orlandini
FUEL ASSEMBLY FOR A FAST REACTOR		
Patent No. : 3,702,803	Issued : 11/14/72	Inventor(s) : P. R. Huebotter
NUCLEAR REACTOR FUEL AND FUEL ELEMENT AND PREPARATION THEREOF		
Patent No. : 3,714,060	Issued : 01/30/73	Inventor(s) : M. Tetenbaum and P. D. Hunt
ALKALI METAL LEAK DETECTOR		
Patent No. : 3,721,970	Issued : 03/20/73	Inventor(s) : H. R. Niemoth
HYDROGEN ACTIVITY METER		
Patent No. : 3,731,523	Issued : 05/08/73	Inventor(s) : D. R. Vissers, J. T. Holmes, and P. A. Nelson
COUNTER FOR RADIATION MONITORING		
Patent No. : 3,732,422	Issued : 05/08/73	Inventor(s) : G. S. Brunson, R. N. Curran, and F. H. Just
METHOD FOR DETECTING AND MONITORING A FUEL ELEMENT FAILURE IN A NUCLEAR REACTOR		
Patent No. : 3,733,249	Issued : 05/15/73	Inventor(s) : W. E. Miller and W. J. Mecham
FUEL PIN FOR A LIQUID-METAL-COOLED FAST-BREEDER NUCLEAR REACTOR		
Patent No. : 3,740,314	Issued : 06/19/73	Inventor(s) : L. A. Neimark
SEPARATION OF AMERICIUM AND CURIUM		
Patent No. : 3,743,696	Issued : 07/03/73	Inventor(s) : G. W. Mason, A. F. Bollmeier, Jr., and D. F. Peppard
PROCESS OF PREVENTING NITRIDATION OF STEEL SUBMERGED IN LIQUID SODIUM		
Patent No. : 3,745,068	Issued : 07/10/73	Inventor(s) : A. K. Fischer
EXTRACTION OF URANIUM FROM AN AQUEOUS SOLUTION		
Patent No. : 3,745,205	Issued : 07/10/73	Inventor(s) : D. F. Peppard, G. W. Mason, A. F. Bollmeier, Jr., and S. Lewey
METHOD FOR DETECTING AND LOCATING FAILED SODIUM-BONDED FUEL ELEMENTS		
Patent No. : 3,746,614	Issued : 07/17/73	Inventor(s) : R. J. Meyer, C. E. Johnson, and C. E. Crouthamel
METHOD OF MEASURING FAST-NEUTRON FLUX		
Patent No. : 3,748,472	Issued : 07/24/73	Inventor(s) : D. L. Smith
FLUORIDE REPROCESSING OF BREEDER FUELS		
Patent No. : 3,753,920	Issued : 08/21/73	Inventor(s) : N. M. Levitz, A. A. Chilenskas, E. L. Carls, A. A. Jonke, M. J. Steindler, LaV. E. Trevorow, L. J. Anastasia, and J. E. A. Graae
FAST BREEDER REACTOR PROTECTION SYSTEM		
Patent No. : 3,764,467	Issued : 10/09/73	Inventor(s) : J. B. van Erp
IRRADIATION SUBASSEMBLY		
Patent No. : 3,767,525	Issued : 10/23/73	Inventor(s) : O. S. Seim, E. C. Filewicz, and E. Hutter
ATMOSPHERE PURIFICATION OF RADON AND RADON DAUGHTER ELEMENTS		
Patent No. : 3,778,499	Issued : 12/11/73	Inventor(s) : L. Stein
HIGH INTENSITY, PULSED THERMAL NEUTRON SOURCE		
Patent No. : 3,778,627	Issued : 12/11/73	Inventor(s) : J. M. Carpenter
ATMOSPHERE PURIFICATION OF RADON AND RADON DAUGHTER ELEMENTS		
Patent No. : 3,784,674	Issued : 01/08/74	Inventor(s) : L. Stein
METHOD OF MEASURING THE TRITIUM CONCENTRATION IN A HIGH-TEMPERATURE ENVIRONMENT		
Patent No. : 3,797,299	Issued : 03/19/74	Inventor(s) : P. A. Nelson and R. Kumar

## METHOD OF SEPARATING THORIUM FROM YTRIUM AND LANTHANIDE RARE EARTHS

Patent No. : 3,804,940

Issued : 04/16/74

Inventor(s) : G. W. Mason, S. Lewey, and D. F. Peppard

## METHOD OF SECRETLY MARKING A SURFACE EMPLOYING FISSION PRODUCTS

Patent No. : 3,805,067

Issued : 04/16/74

Inventor(s) : J. Wing

## GRIP ACCESSORY FOR REMOTE-CONTROL MANIPULATOR TONGS

Patent No. : 3,815,761

Issued : 06/11/74

Inventor(s) : M. F. Adam

## MAGNETOMETER FLOWMETER USING PERMANENT MAGNETS AND MAGNETOMETER ELEMENTS ALIGNED WITH THE FLOW

Patent No. : 3,824,456

Issued : 07/16/74

Inventor(s) : D. E. Wiegand

## MONITOR FOR RADIATION-INDUCED HEATING

Patent No. : 3,826,921

Issued : 07/30/74

Inventor(s) : W. R. Wallin, V. W. Lowery, and R. R. Smith

## ATMOSPHERE PURIFICATION OF XENON, RADON AND RADON DAUGHTER ELEMENTS

Patent No. : 3,829,551

Issued : 08/13/74

Inventor(s) : L. Stein

## GAS VOID DETECTOR FOR LIQUID METAL

Patent No. : 3,830,095

Issued : 08/20/74

Inventor(s) : R. A. Jaross

## RADIATION DETECTOR USING ELECTRO-OPTICS

Patent No. : 3,831,028

Issued : 08/20/74

Inventor(s) : I. B. Kerlman, A. Strash, and J. Kastner

## HEAT SOURCE CONTAINING RADIOACTIVE NUCLEAR WASTE

Patent No. : 3,866,424

Issued : 02/18/75

Inventor(s) : H. M. Busey

## PROCESS FOR RECOVERING URANIUM AND PLUTONIUM FROM IRRADIATED NUCLEAR FUEL OXIDES

Patent No. : 3,867,510

Issued : 02/18/75

Inventor(s) : W. E. Miller, J. F. Lenc, and I. O. Winsch

## MULTIPURPOSE SAMPLER DEVICE FOR LIQUID METAL

Patent No. : 3,872,718

Issued : 03/25/75

Inventor(s) : P. A. Nelson, V. M. Kolba, and J. T. Holmes

## ARCHIVE-CUP INSERT FOR LIQUID-METAL SAMPLING

Patent No. : 3,881,355

Issued : 05/06/75

Inventor(s) : P. A. Nelson, V. M. Kolba, E. C. Filewicz, and J. T. Holmes

## METHOD OF EVALUATING THE PRECISION OF CROSS-SPECTRAL DENSITY MEASUREMENTS OF RANDOM NOISE

Patent No. : 3,886,333

Issued : 05/27/75

Inventor(s) : C. E. Cohn

## DETERMINATION OF PARAMETERS OF A NUCLEAR REACTOR THROUGH NOISE MEASUREMENTS

Patent No. : 3,894,912

Issued : 07/15/75

Inventor(s) : C. E. Cohn

## METHOD FOR UTILIZING DECAY HEAT FROM RADIOACTIVE NUCLEAR WASTE

Patent No. : 3,911,684

Issued : 10/14/75

Inventor(s) : H. M. Busey